NAVAL POSTGRADUATE SCHOOL
Monterey, California

THESIS

CONTRACTING PRACTICES FOR MAJOR WEAPONS SYSTEMS IN THE CHILEAN NAVY: A CASE ANALYSIS

by

Eduardo Troncoso

December 1995

Principal Advisor: Thomas Hoivik

Approved for public release; distribution is unlimited.

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY (Leave Blank)	2. REPORT DATE	3. REPORT TYPE
	December 1995	Master's Thesis

4. TITLE AND SUBTITLE

CONTRACTING PRACTICES FOR MAJOR WEAPONS SYSTEMS IN THE CHILEAN NAVY: A CASE ANALYSIS

5. FUNDING NUMBERS

6. AUTHOR(S)

Eduardo Troncoso

7. PERFORMING ORGANIZATION NAMES(S) AND ADDRESS(ES)

Naval Postgraduate School
Monterey, CA 93943-5000

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES

The views expressed in this thesis are those of the author and do not reflect the official policy or position of the Department of Defense or the United States Government.

12a. DISTRIBUTION/AVAILABILITY STATEMENT

Approved for public release; distribution is unlimited.

12b. DISTRIBUTION CODE

13. ABSTRACT (Maximum 200 words)

The purpose of this thesis is to analyze the contracting practices for major weapon systems procurement in the Chilean Navy. The case analysis method, with emphasis in risk assessment and management, has been used to analyze the procurement of a ship missile system, referred to in this thesis as the "Kilo Missile System". The organizational structure, rules, regulations and authority chains are also analyzed using the Agency theory, the Information Processing model, and the Interpretivist model. Procurement practices used currently by the U.S. Department of Defense and private firms are used as a point of comparison for the case analysis. The analysis shows that the project involved a high risk, which was not realized by the Project Team. However, the competency and commitment of the Project Managers, the good relationship with the contractor, and the commitment of the latter with its national Navy allowed a favorable outcome. The thesis also provides a set of lessons learned and recommendations in the areas of organization, education and Project Management for improvement of future weapon acquisitions.

14. SUBJECT TERMS

CONTRACTING; NEGOTIATION; WEAPONS SYSTEMS.

16. PRICE CODE

15. NUMBER OF PAGES 204

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
Unclassified	Unclassified	Unclassified	UL

NSN 7540-01-280-5500 Standard Form 298 (Rev. 2-89)

Approved for public release; distribution is unlimited.

CONTRACTING PRACTICES FOR MAJOR WEAPONS SYSTEMS IN THE CHILEAN NAVY: A CASE ANALYSIS

Eduardo Troncoso
Commander, Chilean Navy
Engineering Degree
Naval Engineering School, Chile, 1982

Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE IN MANAGEMENT

from the

NAVAL POSTGRADUATE SCHOOL
December 1995

Author: _____
Eduardo Troncoso

Approved by: _____
Thomas H. Hoivik, Principal Advisor

_____
Katsuaki L. Terasawa, Associate Advisor

_____
Reuben T. Harris, Chairman
Department of Systems Management

ABSTRACT

The purpose of this thesis is to analyze the contracting practices for major weapon systems procurement in the Chilean Navy. The case analysis method, with emphasis in risk assessment and management, has been used to analyze the procurement of a ship missile system, referred to in this thesis as the "Kilo Missile System". The organizational structure, rules, regulations and authority chains are also analyzed using the Agency theory, the Information Processing model, and the Interpretivist model. Procurement practices used currently by the U.S. Department of Defense and private firms are used as a point of comparison for the case analysis. The analysis shows that the project involved a high risk, which was not realized by the Project Team. However, the competency and commitment of the Project Managers, the good relationship with the contractor, and the commitment of the latter with its national Navy allowed a favorable outcome. The thesis also provides a set of lessons learned and recommendations in the areas of organization, education and Project Management for improvement of future weapon acquisitions.

TABLE OF CONTENTS

I. INTRODUCTION

A. PURPOSE

The purpose of this thesis is to analyze the contracting practices for major weapon systems procurement in the Chilean Navy during the late eighties. The case analysis method, with emphasis in risk assessment and management, has been used to analyze the procurement practices followed by the Chilean Navy. The case focuses on the procurement of a ship missile system, referred to in this thesis as the "Kilo Missile System"[1] and "Project Kilo".

The thesis also reviews the organizational structure, rules, regulations and authority chains to analyze the contracting environment and relate it to the case. Agency theory, the Information Processing model, and the Interpretivist model are used to analyze organizational and behavioral issues[2]. Procurement practices used currently by the U.S. Department of Defense and private firms are used as a point of comparison for the case analysis wherever applicable. The analysis defines the process and its actors, and develops conclusions and recommendations in the areas of organization, education and administration that are useful for future acquisitions made by the Chilean Navy.

Beyond the specific benefits for the Chilean Navy, Chilean Defense Industry might also learn from this thesis. Although Chilean Industries have not attempted yet to produce and sell sophisticated weapon systems, they have engaged in international contracts in several areas like shipbuilding and light weapons. Officials from those industries can find in this thesis helpful information, which reflects the points of view of their potential customers. Finally, this thesis provides insights about the international weapon procurement process not only to the Chilean Navy but also to any other weapon system buyer, including the U.S. Armed Forces.

---

[1] The procurement project analyzed in this case is classified. Some figures, characteristics, names and dates have been modified, omitted or disguised to protect classified information. The names "Kilo", "ALPHA AERONAUTICS" and country "Omega" are not the real ones.

[2] Models are detailed in Chapter II.

B. BACKGROUND

Weapon system acquisitions for the Chilean Navy are particularly difficult, due to the absence of a strong national industrial base and budgetary restrictions. The great uncertainties and risks created by the need to get leading edge technology, at low cost, and most of it from foreign sources, makes weapons acquisition even harder. Keeping those systems operational in the long run is a critical although often overlooked challenge, especially when the sources of logistic and technical support are spread around the world. Management and decision considerations in this area cover a broad spectrum, including political, strategic, operational, technical, financial and legal issues.

Due to the economic size of the country, the Chilean Navy cannot carry on large weapon development programs. However, if the options are limited to commercially available systems, the Chilean Navy will never achieve a strategic or tactical advantage. This dilemma forces the search for creative solutions, working with foreign countries, private firms, universities and in-house organizations in embrionic programs, joint ventures and non conventional configurations. The need for fluid relationships among all the parties involved cannot be overemphasized.

Contracting for the procurement of a major weapon system is a very important function in the acquisition process. Once a contract is signed, the basis for the relationships between the parties is established, and the future of the system is determined to a large extent. Despite all the changes introduced afterwards, they all relate to the first version of the contract.

This thesis will analyze the procurement of the "Kilo" ship missile system, which contains all the complexities already mentioned, examining the way the contract was negotiated and finally written, and what happened afterwards.

Although the objectives of this thesis, as described in the following paragraph, are oriented to the improvement of the Chilean Navy procurement skills, the analysis can also enhance the understanding between the U.S. authorities (both government and private) and the Chilean Navy, as well as other foreign services. As contractors and foreign government

officials read this thesis, they will be in better position to establish fruitful relationships with the Chilean Navy.

C. THESIS OBJECTIVE

The objective of this thesis is to analyze how the Chilean Navy has dealt with the uncertainties involved in the "Kilo" missile system procurement management. In this context, it focuses on the contracting process, and to what extent it created appropriate relationships with the supplier(s). The thesis also analyzes the organization and rules in which the Navy manages the acquisition and contracting process, as well as the manpower assigned to it, to determine to what extent they are appropriate to the task. Additionally, the case description and analysis will provide a set of recommendations and lessons learned to new generations of Program Directors and Project Managers.

D. RESEARCH QUESTIONS

The primary research question for this thesis is:

- Did the contracting practices of the Chilean Navy deal appropriately with the uncertainties and complexities involved in the procurement of the "Kilo" missile system?

The subsidiary research questions are:

- What are the challenges that the Chilean Navy faces when trying to acquire major weapons systems?
- What are the general political, legal, financial and technical constraints involved in major systems procurement?
- Was the Chilean Navy properly organized and manned for contracting?
- What were the specific contracting challenges and constraints for the case under analysis?
- How did the Contracting Team deal with those general and specific challenges and constraints?
- What conditions influenced the positive and negative outcomes of the contract?

- What could have been done to make the procurement process better within the current constraints?

- What can be done in the future to improve management conditions and eliminate constraints for achievement of better contracts?

E. SCOPE AND LIMITATIONS

This thesis deals specifically with the project "Kilo" case, and consequently with the conditions and circumstances prevailing during that particular period of time. In the context of this thesis the contract is viewed as the conclusion of a process that included need assessment, strategic and tactical decisions, technical analysis, financial analysis, source selection and negotiation. The research will begin at a point where the need for the system and its operational characteristics were already determined, and the decision to acquire the system was supported by the authority chain.

Financial analysis will consider the availability of funds, initial costs, uncertainty of costs and time value of money. Since the budget for major system acquisition is handled in U.S. Dollars, the time value of money discount rate will be the prevailing external debt interest rate. For cost analysis only the contract cost is included.

The analysis of legal aspects is limited to the power provided to the Navy to enforce the fulfillment of the contract. It is initially assumed that both parties are committed to the explicit terms of the contract, although the uncertainties will create unexpected situations, which will require further communication and negotiations within the framework of the contract.

For security reasons, the original contracts cannot be discussed in detail. For that reason some amounts, dates, names and technical characteristics have been modified or omitted, without affecting its value for this research.

Being a case analysis, the results of this research are valid only to the extent that both the environment and the contract under study are representative of those prevailing. However, the changes that are taking place in the political environment and their implications to the acquisition and contracting process are considered in the recommendations found in Chapter VI.

F. METHODOLOGY AND SOURCES

The case analysis method is used in this thesis, which is appropriate to the deductive nature of the research question. Through this research a framework is provided to analyze other contracts within the Navy, whose results will enrich the experience base for future contracts.

The Information Processing Systems and Interpretivist models, as well as the Agency Theory, are used to analyze the contracting organization and control process. These models were selected because they focus on the complexities and uncertainties found in contracting, which is a key issue in this thesis.

The research begins with an inquiry and data collection process based on the contract, related documents and interviews with the main actors of the negotiation and contracting process. Practices followed by the U.S. Department of Defense and private industries when they purchase sophisticated and unique equipment are also explored. This data gathering is followed by an analysis, based on the models already mentioned, the data available, the knowledge gained by the author through the courses at the Naval Postgraduate School, the related literature, and the insight of the advisors. The emphasis of the analysis is on the contractual relationship between the buyer and the seller, and its effect in managing the uncertainties of the acquisition process.

The data consist of:

- The contract, Financial Agreement and posterior changes, included in Appendix A.
- Interviews with the program managers and other naval officers involved in project "Kilo".
- Written reports of program managers.
- Laws and regulations related to the acquisition process and Program Management.
- Organizational charts of the organizations involved.

- U.S. Department of Defense Regulations and other texts related to the topic under research.

- General texts about Strategy, Negotiation, Program Management, Risk Management and other related topics.[3]

G. ORGANIZATION OF THE STUDY

The second chapter describes the political, strategic, legal and financial environment which the major weapon acquisitions were made. It also sets the theoretical framework for the analysis. The third chapter explains the Project Kilo case, including the genesis of the acquisition, the decision process, the negotiation of the contract, the result of those negotiations and the subsequent events. The fourth chapter is the analysis of the case, including the challenges for procurement, the goals of the different parties, the uncertainties and risks, the organizations involved, the interactions among relevant actors and the actual results of the procurement. The fifth chapter gives the conclusions of the case analysis. The last chapter suggests recommendations for improving the procurement process, including propositions for further research.

[3] A Bibliography is presented in page 191.

II. ENVIRONMENT AND THEORETICAL FRAMEWORK

A. GENERAL

This thesis is a case analysis on a major missile system procurement made by the Chilean Navy in the late eighties[4]. This chapter lays down the foundations for the research, explains the general context in which the events occurred and presents the theoretical framework of the analysis.

B. DESCRIPTION OF THE POLITICAL, STRATEGIC, ECONOMIC AND LEGAL ENVIRONMENT

1. Political Environment

During the late eighties, the Chilean government was under the final years of military rule. The new constitution approved by popular vote in 1980 was under effect, and political parties were functioning and preparing the 1988 upcoming elections.

The executive was led by the President General Augusto Pinochet with a civilian cabinet, except for the Minister of Defense who was a retired Admiral.

The legislative power was held by a "*Junta de Gobierno*" consisting of the Commanders in Chief of the Navy, Air Force and Carabineros (Uniformed Police) plus the Vice-Commander of the Army. Each one, supported by a professional staff of law experts, looked after a specific area of government (e.g. senate committees).

The Judicial Power, the only one untouched by the military government, was led by the Supreme Court.

The military institutions were led by their commanders in chief, who had also government responsibilities. Most of the internal management was handled by the Chiefs of Staff of each branch. The Joint Staff provided advice to the Minister of Defense and coordination within the branches, but had no authority over the services. Practically, each service was quasi-autonomous, with its own budget guaranteed in the long term and

---

[4] Summaries of the contract and the financial agreement are enclosed in Appendix A.

reporting only to the President.

In those days, the internal political agenda was centered in the plebiscite to be held in December 1988, in which the voters would decide between the continuation of the military government or presidential elections. The transition agenda was part of the Constitution of 1980. The fast growing economy and the smoothness of the transition process made internal politics rather quiet.

In the international arena, the Western powers (especially the U.S.) were looking carefully at the transition process. However, the Soviet Empire was attracting most of the attention as Poland, Rumania, Hungary, Lithuania and other Eastern European countries were undergoing a dramatic move away from Soviet rule.

Closer to Chile, the southern cone of South America was in the midst of a redemocratization process. However, the main concern was the economy. Different approaches ranging from Socialism to Populism had not been able to recover the South American economies from the oil crisis of the seventies and the debt crisis of the early eighties. The only exception was Chile, where an aggressive free market and export-oriented economy was succeeding in providing growth and stability.

2. Strategic Environment

In the strategic arena, there were no immediate threats to Chile's national security. In the last twenty years Chile went through several crisis situations with Argentina and Peru, but in the period when this procurement was decided, both countries had enough internal problems to occupy their energies.

Argentina became tragically aware of the consequences of military conflict after the Falklands war, and the civilian government was more interested in reducing the power and influence of the military than in the use of military power in external disputes. Peru was in even worse condition, and its military forces were engaged in guerrilla warfare against the Shining Path Maoist movement.

This temporary calm caused by the internal weakness of our neighbors did not assure peace forever. Peru had not abandoned its long term commitment to recover their "lost provinces" after the 1879 war. Argentina still had the ambition for sovereign access to the

Pacific Ocean, and also for control over all the islands and maritime territory east of Cape Horn. At best, those claims would be on hold unless the political leadership or compelling circumstances changed those deeply rooted geopolitical goals[5].

At the same time, the communist subversion that had strongly affected the country and most of South America during the sixties and seventies, creating the need for a military intervention, was collapsing together with the fall of the Soviet Union and its satellites.

Under this environment, the military institutions in Chile were primarily concerned with keeping long term deterrence capabilities. The transition to civilian government was designed with built-in stabilizing devices which ensured the non-politization of officer promotions, the permanence of the commanders in chief for their full period after their nomination, and a stable military budget, with the current one as a floor. However, those devices were only as strong as the political consensus that supported them, and there were signs that they were going to be challenged in the future by the left wing politicians.

Under this politico-strategic environment, Navy leadership was working towards the strength of the human factor to meet the challenging conditions of the future and, at the same time, towards the updating of the aging fleet. Most ships dated from the late fifties to the early seventies. This update was going to require a stable funding effort to purchase and install the new weapon systems necessary to make those old platforms suitable to match the future threats.

3. Economic Environment

As mentioned before, the country was enjoying a period of fast growth and consolidation of the economic system. After the ruinous economic conditions left by the demised socialist government in 1973, the country faced the oil crisis. The prices of the raw materials that Chile exported plummeted while the prices of imported manufactured goods rose sharply. After a long and painful effort to restart the economy under the rules of the free market, the country was in spectacular performance when the debt crisis hit in 1982. The

---

[5] As we know now "after the fact", bilateral relations were dramatically enhanced through a fast development of across-the-border private investment among Chile, Argentina and Peru.

consequences were disastrous (20% fall in the GNP), but the lessons learned and the ingenuity of the economists made it possible a for new recovery. This recovery was less spectacular than the previous one, but much more stable and structurally safe.

To make this recovery possible, government austerity was a must, and the armed forces were not going to be an exception. The hardships of the recovery effort had created social demands that could not be postponed.

The key actor in those days was the Ministry of Finance (*Ministro de Hacienda*), the watchdog and arbitrator of government spending, and recipient of pressures from all sectors. The budget designed by his cabinet was consistently approved.

Due to this austerity effort, the Navy could not commit to buy new ships, because the cost of a single ship would have exhausted the procurement budget for several years. In the past, ships were bought under special laws, apart from the regular budget. However, this was not now possible. Therefore, the Navy was forced to look for other options to repower the fleet, like putting new weapon systems on old platforms. That is the kind of acquisition that occurred during this case.

4. Legal Environment

The legal regulations relevant to major system acquisition are basically the same that applied to all government acquisition over a certain value threshold.

According to the current law[6], the main rules were:

On May 1 each Service submits an Investment Plan for the following fiscal year (which begins January 1). The plan is approved by the Superior Council for National Defense, which is an autonomous board that reports directly to the President, and is composed of:

- The Minister of Defense, Council Chairman.
- The Ministers of Foreign Relations and Finance.
- The three Service Commanders in Chief.
- The Chief of Joint Staff.

---

[6]Law 1.744 and its Complementary Regulation, March 1958.

- The three Service Chiefs of Staff.
- The Subsecretaries of the Army, Navy and Air Force.

The approved plan is submitted to the President through the Ministry of Defense. That Ministry includes the approved plan in the proposed budget for the following year.

The budget is submitted to the Congress (*Junta de Gobierno*) in September. There is little uncertainty about approval because the minimum funding level in foreign currency is guaranteed by law as a percentage of the sales of copper[7].

The authorized methods of acquisition for major items (above US$ 10,000) were:

- Public solicitation for bid except in the circumstances mentioned in the following point.
- Private solicitation for bid under one of the following circumstances:
  - The equipment is required in 30 days or less.
  - There is not enough competition (four or more suppliers).
  - The Council approves it by majority vote, and the acquisition is not against the Investment Plan.
- Direct negotiated acquisition if there is only one source or if the acquisition is from government to government.

The bids are submitted, opened, and awarded according to commercial practices. The service Economic Board makes a record of the bids' opening details, the characteristics of each bid and the award criteria (not necessarily price).

The Economic Council for National Defense approves or disapproves the procedure and confirms the award.

There are several formalities about publication, deadlines, and forms to be used and exceptions.

In the case of foreign acquisitions through Public Bid Invitation, the offeror must provide a warranty note for three percent of the value of the acquisition. After award, the contractor must provide warranty for ten percent of the value of the contract, in the form specified in the Invitation for Bid.

---

[7]Chile was -and still is- the first copper producer and exporter of the world.

Transportation of the items from the country of origin must be on a Chilean flagship, with exceptions made for availability or foreign agreements.

When contracts involve payments for future budgets, the funding is provided by a Supreme Decree, signed by the President.

The Contracts are signed by the Commander in Chief or the Service Authority appointed by him for that purpose. In the case of the Navy, the *Director General de los Servicios* (Director of Finance and Logistics).

5. Organization

Within the Navy, the early decisions in major system acquisition processes were monitored directly by the Navy Chief of Staff. Once a concrete idea was granted the category of Project, it was assigned to a Program Director, an Admiral who oversees several related projects. The Program Director, in turn, appointed a Project Manager, who concentrates the responsibility and authority to proceed with the steps that eventually would end up in an acquisition process. His degree of autonomy and authority will depend on his skills in confidence building, and on the sensitivity of the project. The job of Program Director and Project Manager are usually temporary and collateral assignments.

Since the contract for Project Kilo was between government organizations of two countries, they decided to sign it in a neutral field, specifically, the State of New York. An arbitration system was designed within the contract.

C. THEORETICAL FRAMEWORK

The purpose of this section is to provide the description and framework for the analysis of the Project Kilo case in the following sequence:

- General description of the procurement process and challenges from the perspective of the Chilean Navy
- Contracts and their role in the procurement process
- Environment in which this process takes place, with emphasis on the actors and their relationships
- Uncertainty, risk, different components of risk, and causes of risk

- Models used to analyze the organizations involved
- Decision making process under uncertainty

All of these points provide a framework for a better understanding of the case, described in Chapter III. They are used again in Chapter IV to analyze the case from different perspectives, helping to understand and to evaluate the way the project was handled.

1. The Acquisition Process and its Challenges

Major weapon system acquisition is a complex process which includes research, decision making, investment, management and communication effort. There is no other decision making process in government that assigns such large amounts of resources to a single system. The Project Manager (who is also the Contract Manager in the Chilean Navy) works at the epicenter of this process.

Within this process, perhaps the most challenging phase is dealing with the providers of goods an/or services, as offerors and contractors. The complexities arise from the following factors, which include:

- Different and competing interests
- Asymmetric information about capacity, cost and intentions
- Different culture, assumptions, language and ethical standards
- Different risk management approach
- Different sources of information
- Different management structure
- Competing commitment to third parties
- Policy and regulatory restrictions
- Different historical perceptions
- Limited degree of mutual trust
- Lack of buyer's commercial experience
- Rotation and discontinuity in decision makers, more often on the buyer's side

2. The Contract as a Communication and Risk Reduction Device

Given the situation described above, the contract becomes the cornerstone of the relationship between buyer and seller, where all expectations on both sides are converted into a solid agreement. However, this agreement is not the beginning of the relationship, but the culmination of a process of exploration, selection and negotiation.

But the contract is not the end of the process, since there are always areas of uncertainty, autonomy, indefinition, interpretation, and misunderstanding that must be resolved after the contract. Moreover, there is always a risk of failure to fulfill the contract, where the provisions for such failures are tested if included, and negotiation skills play a key role.

The contract is by itself a communication and risk reduction device. A good contract should be able to communicate unequivocally the expectations and obligations of both parties, provide means to prevent and solve any expected inconvenience, and provide room for the unexpected.

The definition for contract used in the Naval Postgraduate School says: "Contract is a promise or set of promises for the breach of which the law gives a remedy, or the performance of which the law in some way recognizes as a duty"[8]. The same source specifies the following elements of a contract:

- Capacity: The authority and competency of those who sign the contract
- Offer: The communication of the intention to provide goods or services, specified in a complete, clear and unambiguous way
- Acceptance: The promise of acceptance of the goods provided so far they conform with the offer
- Consideration: Mutual promise to compensate for the goods or services accepted, and to accept of the enforcement means provided. It may include the promise to no act legally against the other party outside the terms of the contract

[8] Class notes for MN 3371: "Contract Management and Administration".

- Certainty of terms: The clarity and unambiguity of all terms of the contract, and the provision for a solution in the case of different interpretation[9]

- Lawful purpose: The obligations of the contract should not force the parties to break the law. The obligations should also be possible to fulfill in a legal way with reasonable means

- Form: Contracts may be oral, written or recorded in some other media. For this kind of contracts, other than written form is not conceivable

There is a natural trend to expect commitment from both parties to the contract, and even in this case only very good contracts will succeed in providing adequate communication and problem solving devices in case of unexpected events or involuntary failures. However, as the definition above emphasizes by putting it in the first place, the breach of the contract must be considered as a possibility. This should not be considered offensive during the negotiation phase.

Contractor and government agents[10] have multiple commitments and constituencies, and sometimes they might sign a contract even knowing beforehand that they are not capable of fulfilling it. It may also happen that a contractor signs with the best of the intentions and commitment, but changes in circumstances or leadership forces an intentional failure. If on top of all the mentioned risks we put the chance of wrongdoing or fraud, the picture becomes even more complex.

Moreover, no matter how complete, clear, or prophetic a contract might be, if it is not backed by enforcement authority, the parties are left to the goodwill of the other (which may turn out to be very convenient). This situation is frequent when dealing between two countries, since there are no means to impose the rule of international law other than sanctions or force, which are not used in this context. On the other hand, international

---

[9] In government contracting, if there are two different interpretations to a clause, that of the party that did not write the contract prevails, thus assuming advantage of the party who wrote the contract.

[10] An agent is a person who acts on behalf of the organization. Agency theory, which deals with the conflicts of interests between the agent and the organization, is discussed in this chapter.

sanctions can cause a contract failure. The case of the recently aborted acquisition of F-16 fighters by Pakistan is a sad example of this kind of failure[11].

Under such conditions, the challenge for the agents of the Navy and the seller in charge of creating a contract is:

- Develop a deep understanding of each other, its capabilities, constraints, priorities, values, language, culture, procedures, methods and any other circumstance that can affect the relationship within the parties
- Communicate mutual expectations in a way that both parties understand and agree
- Ensure that the promises cover all the requirements of both parties, not only about the goods or services, but also about how, when and where will they be delivered, what will be the future obligations after the delivery, what related support is required, what is included in the contract and what is not, and what criteria will be used to clarify unexpected doubts
- Negotiate conditions that satisfy both parties and that are feasible for both
- Explore all possible cases of non fulfillment and design incentives to avoid such circumstances
- Explore all possible cases of misunderstanding or misinterpretation, and design mechanisms to avoid or overcome such events
- Determine how the incentives or remedies will be enforced if necessary. Determine also other avenues that could be used by each party to ensure contract compliance
- Determine the consequences of a termination for both parties in all significant phases of the contract, and ensure that it will always be more beneficial to solve the problems rather than terminate the contract
- Relate the current contract with other current or potential commitments; determine how important the contract is for both parties relative to those other commitments.

---

[11] Pakistan contracted and paid for the purchase of F-16 aircraft. The purchase was stopped by the Congress, but the money was not reimbursed. In a recent visit to the U.S., Prime Minister Benazir Butto tried unsuccessfully to get delivery or recover the money.

- Design mechanisms to introduce changes in the contract if agreed to by both parties

- Specify the level of authority that the agents and principals had on both parties for the purpose of changes, renegotiation and problem solving

- Determine the relative bargaining power of the parties throughout the negotiation process and during the performance of the contract

3. Actors Involved in the Contract

In contracts such as the "Kilo" procurement agreement, at least two complex organizations are engaged, and the agents in charge of negotiating and designing the contract are subject to multiple demands.

The purchase of weapon system by a government agency is the result of the balance of different pressures, represented by some organization or authority, which can be more or less desegregated. For analysis purposes, this thesis refers to them as follows:

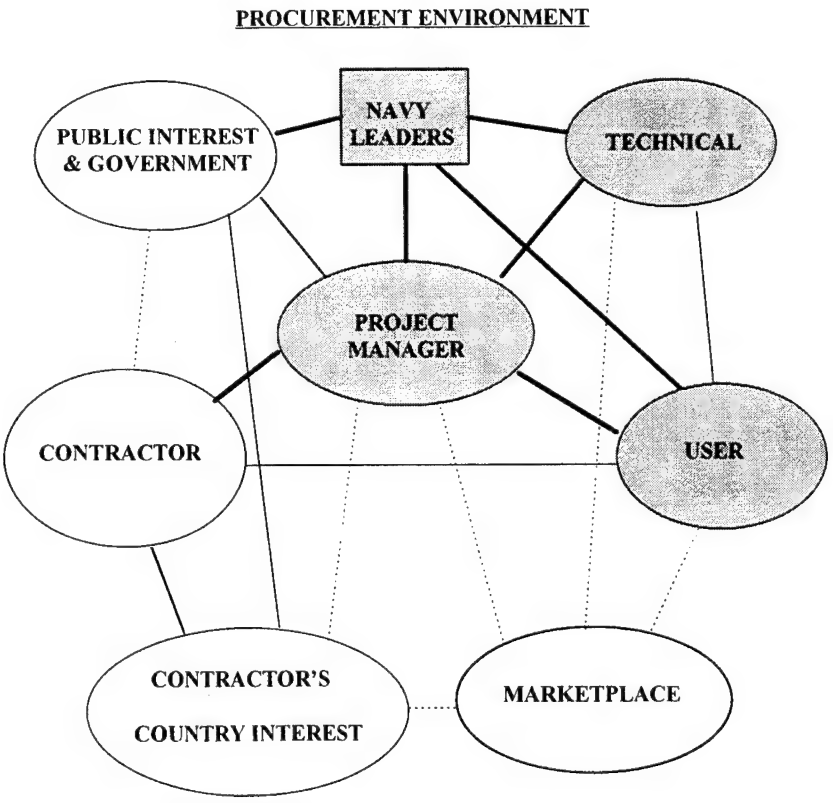


Figure 2.1 Actors and Relationships in the Procurement Process

a. ***The User*** is the direct user command or the operational command, who cares about the use of the system, why it is being purchased, how it will be used, by whom, against what, in prevention of what. They are also concerned about the training and operating procedures for the system.

b. ***The Technical Authority*** is the authority responsible for the technical ability of the system to accomplish its mission, the applicable standards, the relationship with the logistic support system, and the technical compatibility with other system that will be related to it (e.g. power supply, communication, interferences, and size). Usually the project Manager is part of the Technical Authority or has strong ties with it. It is also usual that the Operational Command has some or all of the technical authority.

c. ***The Public Interest*** is represented by the government, defense or branch authorities, who will provide the resources for purchasing activities, and the legislative power which will authorize the funds and oversee the performance of the contract. Their responsibility is to decide if this particular project deserves the resources asked at each step, given availabilities, other alternative usages or requirements, and the "higher interest of the nation."

d. ***The Navy Authorities*** who, with part of the government, has its own goals, perspective and agenda. Navy leadership must follow government guidance, but is also responsible for the promotion of naval power within the government and the public in general. Weapons systems are the visible face of naval power. Additionally, the complexity and visibility of the acquisition process makes it a showcase of the management capacity of the Navy. Consequently, Navy leaders have an involvement beyond mission fulfillment when dealing with weapons system acquisition.

e. ***The Contractor(s)*** are the companies that will provide goods or services to the procuring agency in order to make the system, or part of it, a reality. They will design, built, test, and transport. Their responsibility is to get the highest possible profit in the short or long term, according to their company's policy, and to keep the purchasing agency convinced that they are getting the best at the lower possible cost. However, their main initial goal is to win the contract.

f. ***The Contractor's Government*** will care for the implications of military sales in its foreign affairs and national security. Weapon sales are clear signals of friendship, hence a compromise with the buying government, and third parties as they relate to that government. There is also the concern about the chance of the weapons being used against the seller or its allies[12].

Some countries (including the U.S.) use foreign trade and foreign military sales as a foreign policy tool, which is a serious concern for potential buyers, which must take the sellers politics into account when requesting bids.

g. ***The Marketplace*** is the network of users and suppliers of similar or related systems, components and parts of them, and the financial market that provides funds to them. This network establishes the standards for performance, price, quality and service related to the acquisition of the system.

h. ***The Project Manager*** is the central actor in the process and the officer assigned with the task of procuring the system. He will get some resources to pay contractors or to afford administrative expenses. His responsibility is to get the system into operational status as soon as possible with the resources assigned, with the lowest possible risk and satisfying the "user" and "technical" specifications and expectations. He would like to accomplish this with the minimum possible interference. Dealing with a few experienced potential contractors who understand the process and needs is the ideal.

4. Risks involved in Procurement

Risk is a major issue in procurement, and also the main focus of this thesis. This point defines risk as different but related to uncertainty, and provides a workable classification for risk analysis.

a. ***Definition of Risk***

According to the Acquisition Strategy Guide edited by the Defense Systems Management College, "Program Managers should thoroughly address risk assessment. There

---

[12] During the Falklands war HMS Glamorgan was hit by an Anglo-French Exocet fired by Argentina.

is evidence to suggest that this is the most important review/approval consideration in the acquisition strategy."[13]

The same Strategy Guide defines risk as a measure of the probability and consequence of not achieving a defined program goal. This definition refers implicitly to uncertainty when mentioning probabilities. Specifically, the probability of achieving a variable of an "equal or better" value than the expected implies the existence of a distribution of possible values, and a threshold of satisfaction. A value below the threshold means failure, and the probability area at the left of the threshold is the uncertainty component of risk.

The problem is that establishing an accurate probability of achieving a goal or a set of goals is a difficult proposition. Success and failure are not necessarily on/off situations, and the consequences of failure depend also on the degree of failure. If evaluating success or failure of an event is difficult, predicting it is even harder. Uncertainty has two major ingredients:

- The "known unknowns" are those areas when the causes for variable results can be characterized and quantified via statistical tools or expert judgement.

- The "unknown unknowns" are those factors arising from unexpected sources that can affect the outcome of the project. By definition, they cannot be characterized and less quantified. Only a strategic approach can create the conditions to deal with these factors when they arise. Techniques like war gaming, scenario simulation and team analysis with heterogeneous groups of people can reduce the size and impact of the "unknown unknowns", as well as improve the ability to obtain early assessment of these factors when they appear. Notice that the "unknown unknowns" may have either a positive or negative impact.

The other component of risk is the consequence of not achieving the goal. Between two equally probable events, the one with the higher associated cost will have higher risk.

Risk can be expressed mathematically as follows:

$$Risk = F(P_F, C_F) \qquad \textit{Equation 2.1}$$

---

[13] Acquisition Strategy Guide, Defense Systems Management College. Fort Belvoir, Virginia. First Edition July 1984.

Being: P_F= The probability of having a result below the expected, according to a probability function. This function captures only the "known unknowns" portion of uncertainty.

C_F=The consequence of the negative result, including monetary and non-monetary impact. This value should be expressed in terms of the opportunity cost of the adverse outcome.

b. Areas of Risk

Risk can be divided in three major areas as follows:

- Procurement risk is the risk of not achieving the goals of cost, schedule and/or performance established as baseline for the project due to failure of the seller to deliver the system as expected.

- After sales support risk is the risk of not being able to operate the system as expected due to lack of technical and logistic support from the seller, the buyer himself, or other parties. Depending on the characteristics of the contract, after sales support can be tied to the procurement.

- Political risk is the risk of failure to achieve the goals of the project due to events occurring up in the decision making chain of the buyer or the authorities of the seller's country. It can include changes in funding, new requirements, size reduction or even the cancellation of the project. This area also includes the effect of foreign policy in the fulfillment of the contract and subsequent support when the seller or its subcontractors are not domestic. This is usually the case for the Chilean Navy.

This classification serves only for the purpose of analysis, since the different components or causes of risk are not independent. For example, a change in size or requirements classified as "political risk" might have an effect over cost, schedule and performance.

(1) Procurement Risk is the area of risk traditionally associated with procurement, including cost, schedule and performance.

(a) Cost. Cost risk is usually associated with the type of contract, the most characteristic ones being the Firm Fixed Price (FFP) type and the Cost Plus Fixed Fee (CPFF) type. In a Cost Plus Fixed Fee type contract the buyer bears all the cost risk. The seller is obligated to provide its best effort in accordance with the negotiated

proposal. Since this type of contract is not feasible when the Chilean Navy procures goods or services to foreign countries, there is no further analysis of this kind of contract in this thesis.

In theory, in a Firm Fixed Price type contract the seller bears all the cost risk. However, there are several instances where the buyer can end up paying more than the initial price stated in the contract. The following are some examples of situations where the buyer is forced to pay more than the expected price:

- The buyer is forced to pay for extra performance because the seller can only provide a superior system, and the one with the required performance is out of production.
- The buyer may be tempted to pay for an extra performance offered by the seller.
- The buyer is forced to pay for an extra feature, device, service or special tool not included in the contract but that turns to be indispensable for the safe and/or effective operation of the system.
- The buyer is forced to pay for goods or services that seemed to be included in the contract, but were excluded by some tricky clause. The following are examples of those clauses: Force Majeure, Insurance, Taxes, Transportation, Storage or Supervision Expenses.
- The buyer is forced to renegotiate the price under pressure by the seller, with the seller using a "Pay more or I go out of business," or, "this cost much more than expected" argument.
- The buyer is forced to spend extra money in travel, supervision or other unforeseen expenses.
- The seller refuses to pay late fees or other dues.
- The buyer is forced to spend money in legal battles with the seller or is forced to settle at a disadvantage.

Apart from these situations, it is often the buyer who puts himself at risk when requiring changes to the contract, thus opening it to renegotiation. In 1976, Larry Yuspeh from the Joint Economic Committee wrote: "Because change orders are

allowed so regularly in major weapon system contracts, fixed price contracts have essentially been transformed to the cost plus percentage of cost type."[14] This is particularly dangerous under the so called "constructive changes", when the contractor performs work beyond the contract, perceived as informally ordered by the buyer or caused by the buyer's fault.[15]

There are a variety of adjustments and incentives that can modify a firm fixed price contract in order to share risks and motivate the parts to commit their efforts to the success of the contract. Some adjustments refer to variables that are out of control of the contractor, such as interest rates, inflation, exchange rates, wage levels and cost of materials. Other adjustment or incentives are directed to variables that should be under control of the contractor, such as the allocation of scarce corporate resources to the fulfillment of the contract. This is usually reflected in timeliness and quality of the delivery and responsiveness to the needs of the buyer.

(b) Schedule. A schedule overrun is always a problem for both the seller and the buyer. Technological advances often result in a system becoming obsolete before it is fielded. The buyer and the seller share the risk on schedule upon the arrangements of the contract, which include late fees, price adjustments, interest or even termination.

From the buyer's perspective, any delay means losing a tactical or strategic advantage over the potential enemies, which translates in terms of opportunity cost. The effect of the delay depends on the criticality or of the system being procured in terms of the strategic or tactical need for it and the competitive edge that the system represents.

From the seller's point of view, a delay can be the result of his inability to fulfill the contract even after his best effort. Delays can also result from not

---

[14] Larry Yuspeh: "A Case for Increasing the Use of Competitive Procurement in the Department of Defense". Included in "Bidding and Auctioning for Procurement and Allocation: Proceedings of a Conference at the Center for Applied Economics New York University" Edited by Yakov Amihud. New York University Press, New York, 1976.

[15] MN 3371 Class Notes, Naval Postgraduate School.

committing enough resources, because they are more profitable in other place. This is more likely to happen if the seller has no other commitments or future prospective with the same buyer. Therefore, the buyer's risk is fielding the system later than expected and receiving a remedy that is lower than the opportunity cost of that delay.

The contract must provide for enough incentives to ensure the best effort from the seller, and remedies cover the opportunity cost of any delay. Whereas the opportunity cost is very hard to determine, the optimal late fees can be approached through analytical tools.

(c) Performance. Establishing what the system is expected to accomplish, under what conditions, how it will be operated, and how will it be supported is a difficult task. The perception about what is needed may vary among the different actors on the buyer's side. The final user, the Project Manager, the service command and staff, government authorities, legislature, the media and the public at large will have different interests.

Even if there is a common understanding about the needs, codifying them in an unequivocal text is practically impossible. No matter how comprehensive or precise, there should always be room for features not included in the specifications, if only to be able to exploit the creativity of the supplier or incorporate new ideas from the buyer.

If the procurement includes a development phase, there is an expected (and desired) uncertainty about the final features of the system. The system will be expected to match the capacities of determined potential enemies, which the buyer may know only partially. Those determined enemies might not be the ones which the system will finally engage.

Other difficulties arise when trying to establish the boundaries of the system and its links across those boundaries. This is especially difficult in retrofitting projects, such as the subject of this thesis. The designers need extensive information about the signals, power, supplies, coordination, and other interactions across the boundaries. That information is often incomplete, inaccurate, or outdated. Consequently, the design relies on

incomplete information and a set of assumptions.

This lack of reliable information takes its toll at the integration phase, forcing several changes, adaptations, and eventually a complete redesign of the system or its surroundings. These changes end up extending the boundaries of the system.

An aggravating factor of this "integration risk" is that multiple actors are sharing responsibilities, including the manufacturer, the user, technical authorities, the installers and above all, the project manager. When problems arise in the integration, it should be expected that some actors will blame the others, and only adequate communication and teamwork can overcome these difficulties.

(2) After Sales Support Risk: Once the system is fielded, keeping it operational is a complex task. It is accomplished by the users, in-house support organizations, the seller, other organizations in the marketplace (such as spare part suppliers), and other governmental organizations, domestic or foreign.

The design of the life-cycle logistic support system must be consistent with the design of the weapon system itself and the use of it. Whatever logistic support the seller is going to provide or allow others to provide should be in the contract. In this category some examples are:

- Provide any spare parts needed for "x" years at reasonable prices
- Provide the test equipment, special tools, software and all elements needed for maintenance and logistic support
- Provide the training, supervision and technical support for in-house maintenance
- Provide the documentation and technical data needed for maintenance, diagnosis and spare parts identification
- Provide the technical data required for upgrades or integration with other new systems
- Use international standard for parts, integration links or modules
- Use commercially available parts and materials to certain extent

- Keep a network of technical assistance, part sales and authorized maintenance facilities within or close to the bases where the system is maintained, or in certain areas of operation

- Ensure the availability of technical support, parts and services without restrictions by the seller (e.g. exclusive distribution channels) or its government (sanctions or embargoes). Otherwise, the capacity to perform in-house (or at least in the country) support must be acquired with the system

- Use of a language understandable for all parties involved, typically Spanish or English

Another approach to avoid the risk of poor after sales support is choosing a system or components currently in use by other customers nationwide or worldwide. Weapon systems may share several components of industrial use in aeronautics, computers, communications, power supplies, structures, cabinets, displays, safety devices, and others. Having a broad customer base will provide the incentive for a better customer service network, and also alternatives for technical assistance and cooperation among the customers. The disadvantages of this approach is that if potential enemies have the same weapon system, there is less advantage in having it, and if the system is used worldwide it may be obsolete.

In summary, the ideal is to procure a new and original system made with commercially available components, with a few but critical distinctive devices or features providing the competitive edge.

(3) ***Political Risk***: In 1827, the famous strategist Carl von Clausewitz wrote: "War is nothing but the continuation of policy by other means."[16] Experience shows that pretending to isolate politics from military decisions is not realistic. The government is responsible for creating military power for the security of the nation and the promotion of its interests. Within the government, the military services have to figure out what weapon systems might best serve the needs within the budget constraints. What seems

---

[16] Clausewitz, "Note of 10 July 1827," On War, 69. Cited in "Makers of Modern Strategy: from Machiavelli to the Nuclear Age", edited by Peter Paret. Princeton University Press, Princeton NJ. 1986.

a straightforward process is frequently a complex interactive struggle, where several factors other than military considerations get into play.

Once the weapon procurement project has gone through all of the authorization steps and has secured the funding, final negotiations take place and the contract can be signed. However, after signing the contract the risk is even higher, since higher level decisions may force to change or even cancel a contract to which the service is already committed. This interference creates tension between the project manager, the decision makers, and the contractor. For the most part, the political risk is borne by the contractor, but this can be easily reversed when dealing with foreign contractors.

In international agreements, the contractor's government authorities may also be part of the political risk of the project. Military sales represent a political signal between the governments of the seller and the buyer. Any disagreement between the governments in political issues is likely to be reflected in the performance of the contract, or in the support after the delivery of the system. The stability in the relationships between the governments, and the record of using military sales as political tools should be evaluated in the source selection process.

5. Models Used in this Thesis.

For a better understanding and systematic analysis of the factors involved in the case, three models have been selected to be applied in this thesis:

- The Information Processing Model
- The Interpretivist Model
- The Agency Theory

The Information Processing model is used to analyze the shortage of information on both parties, and the mechanisms available to reduce that shortage or to handle it.

The Interpretivist model is used to evaluate the management control systems in place as related to the uncertainty in the goals and tasks, which relates to the shortage of information mentioned in the previous paragraph.

The agent theory provides insight about the conflicts generated between the agents and within their organization. Again, the asymmetry of information acquires relevance in the

analysis.

a. The Information Processing Systems Model

This model, based on the work of John Kenneth Galbraith, focuses on the decision making process in organization as a result of the availability of information, and the human ability to process it. In this context, uncertainty is defined as:

> *"The difference between the amount of information already available for task execution and the amount of information required for the job"*

Notice that this definition describes uncertainty in terms relative to the task. If we recognize that a task can be successfully performed with imperfect but appropriate information, or in other terms, with an acceptable degree of uncertainty, that acceptable level becomes the "zero uncertainty level" for the purpose of the analysis. It is important also to differentiate the concept of "data" versus "information", which is data processed in such a way that presents a relevant, understandable, workable and meaningful picture to the decision maker. Figure 2.2 illustrates the framework provided by this model.

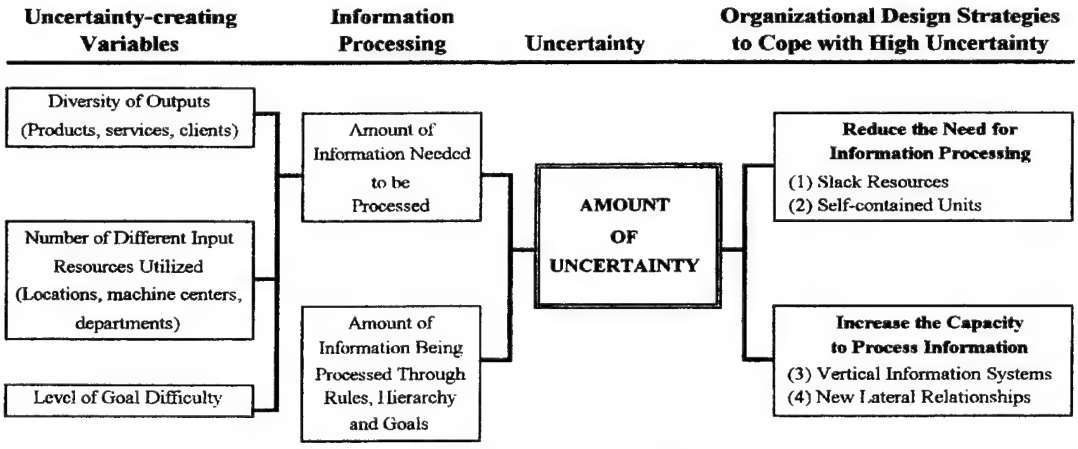


Figure 2.2 Information Processing Model

Organizations gather, create, process, store, and disseminate great and ever increasing amounts of data and information. According to this model, organization design and the quality of the information processing systems determine to a great extent the availability of information to the decision makers.

These information requirements are in turn function of three task characteristics:

1. Output Diversity: the number of different tasks, products, services, customers and programs that the organizational unit has to deal with

2. Input Resources Variety: the different kinds of expertise required, different work locations, and working variables like inventories, suppliers, and others required to manage the unit

3. Goal Difficulty: complexity inherent to the task, and the level of quality expected by the internal and external customers.

To provide the required information, the organization has a set of rules, goals and hierarchies. They prescribe behavior, provide consistency for routine situations, codify past experience, and create the channels for information flow within the organization. This organizational design includes implicitly the information systems, like computers, networks, data bases, and the related procedures for its maintenance and use.

Organization can respond to uncertainty with four "*uncertainty-reducing strategies*":

- ***Slack resources.*** In place of information, certain excess of resources are used to reduce the burden over the decision maker. Excess inventory, longer delivery times, extra capacity or extra budget are some examples of slack resources.

- ***Self Contained Units.*** This strategy aims at the goal difficulty, by concentrating all the operations related to certain segment of the market or product. This shift from functional to divisional or project organization makes the task of each unit more varied but less demanding of information, since the whole network of costumers, suppliers and processes for their specific segment is controlled by the division.

- ***Vertical Information Processing.*** This strategy increases the capacity to process information through improved information and reporting systems, designed to process and distribute the information more efficiently, giving the decision makers more complete, real-time and ready-to-use information.

- ***New Lateral Relations.*** This strategy involves the selective creation of lateral linking relationships to share critical information between departments, without involvement of higher levels. This strategy is complemented with the location of decision centers as low as possible in the organization, where the

action is taking place. The lateral relationships would provide this empowered decision makers with the necessary corporate point of view. Decisions at the top are no more operational but strategic, requiring less internal information.

All these strategies are widely used, and are relevant to the Project Manager organization, which is a good example of a self-contained unit. Each of them contributes to a reduction of the uncertainty in decision making, but at the same time they place new demands on management skills, commitment and coordination. They also require a clear strategic direction from the top, since middle managers have more and better information to decide, but nothing replaces a clear purpose and direction.

b. The Interpretivist Model

This model, presented by Neil MacIntosh[17], looks at the interaction between an objective reality and the subjective interpretation of that reality made by the management control system. As applied to management control systems, the model focus on the different uses of the outcomes of the control system, both in their pure content and in the implications for the members of the organization.

The Interpretivist model is an approach to deal with the issue of uncertainty in management control systems. It evaluates the degree of knowledge about the task to be performed and the goals to be attained through it in a two-dimension domain, as shown in figure 2.3.

In summary, the model states that only if there is good knowledge about the objectives and the task process, control systems can and should provide clear-cut answers based on the data gathered and processed by the system. However, this is seldom the case, and MacIntosh argues that the information provided by the control system is often misused when uncertainty exists.

---

[17] MacIntosh, Neil: Management Accounting and Control Systems. Wiley 1995.

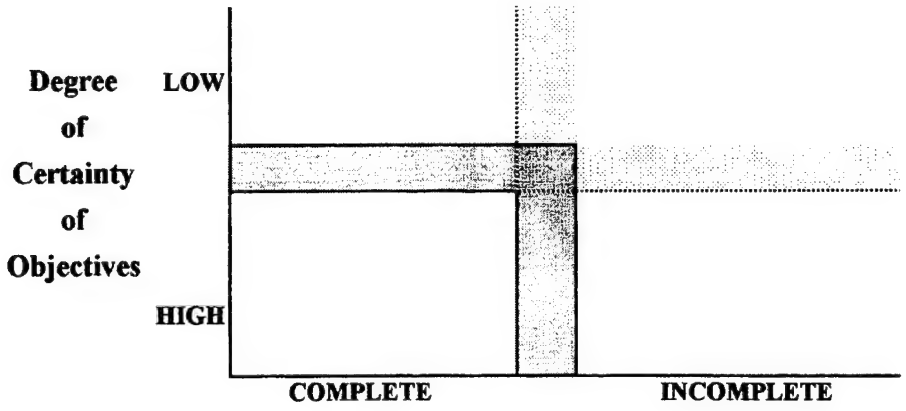


Figure 2.3 Interpretivist Model Matrix

The following table contrasts the proper against the often improper use of the control system outputs:

	PROPER USE	IMPROPER USE
UNCERTAINTY ABOUT GOALS	Stimulate learning. Provide data for judgment.	Generate answers. Camouflage uncertainty.
UNCERTAINTY ABOUT TASK	Promote debate. Provide data for comparison.	Influence decisions. Provide ammunition to an argument.
UNCERTAINTY ABOUT BOTH TASK & GOALS	Generate/test ideas. Simulation. Sensitivity analysis.	Rationalize already taken decisions.

Table 2.1 Use of Control Systems under Uncertainty

c. The Agency Theory

This theory describes how one person (agent) acts on behalf of other (principal) in accordance with an explicit or implicit contract. This model is often applied to managers acting for their organizations. In this case, it is especially relevant, since both parties are represented by agents.

It is expected that the agent will do his best to satisfy the goals of the principal, mainly because the principal has trusted him for some good reason, and he is being evaluated and rewarded accordingly. However the following factors can drive different outcomes:

- ***Asymmetric information.*** This is one of the main aspects of Agency Theory. It refers to the access the agent has to information that is not available to the principal, what allows him to depart from the interest of the principal with no evidence of it. All of the other problems mentioned below stem from this asymmetry.

- ***Self interest.*** The interest of the agent may be stronger than the loyalty and rewards expected. This conflict of interest is the other main aspect of the agent theory. The big questions is to what extent the agent will be loyal to the interest of the principal instead of his own. In contrast, the challenge is to find ways to make both interests as close as possible.

- ***Adverse selection.*** The principal "contracts" the agent assuming that he fulfills the requirements for the task. The prospective agents possess privileged information about their own capabilities, allowing them to mislead the principal. In another case, the principal might hide the difficulty of the task when "contracting" the agent, out of fear to lose him or simply because of underestimation. In both cases, the agent might become overwhelmed by the task.

- ***Moral hazard.*** Depending on the extent to which the agent is liable or accountable for the results of his decisions, he might have an incentive to put less than the best effort. As the principal puts measurement systems in place to incentivize the agent, the latter might be better off complying with the control system rather than putting the best effort.

- ***Signalling.*** The agent tries to demonstrate his abilities to the principal through "signals" that can be specific attitudes, reports and other efforts that might not coincide with the needs of the principal. Usually it is the principal who drives these signalling efforts, as he tries to ensure that he has the right agent requiring early and visible evidence of his competence. The traditions and culture of the organization builds a picture of the competent manager, which those in that position try to fulfill.

- ***Incentive schemes.*** The principal can create a set of measures and rewards to incentivize the agent. However, it is almost impossible that those incentives can always coincide with the best interest of the principal.

Consequently, the agent will have to make the choice between what he considers the best for the principal and what the incentive system proposes. Finally, it might be more comfortable and rewarding for the agent to make the minimum effort needed to achieve a basic satisfaction according to the reward scheme, instead of putting his best effort without equivalent marginal benefit, and creating higher expectations for a next period.

6. Decision Under Risk

Combining the concepts of risk analysis and the models just described, the following decision process can be recommended for making decisions under situations of risk. Since all projects require multiple and interrelated decisions, this process is aimed to find a set of acceptable decisions. The final choice has to be taken in the context of the whole project.

The process is based in the definition of risk, combining uncertainty about the outcomes and the consequences of adverse outcomes. It takes into account also the actions prescribed by the three models presented in point 5. above. The suggested steps are:

a. ***Define Utility***. Determine what is the purpose of the decision and the value that the outcome has for the organization.

b. ***Define the expected outcomes***. Establish in the most clear and measurable possible manner what is considered a successful outcome from the decision.

c. ***Define risk in terms of alternative outcomes***. Define what outcomes might occur, different and worst than the expected outcome. Notice that only the "known unknowns" can be assessed at this point.

d. ***Assess aspiration level for decision.*** According to the value of the outcome, determine how accurately risk must be assessed and how much is acceptable. This assessment is the basis for the resource allocation into the decision process (e.g. people, money, time, authority, and information).

e. ***Clarify the decision making framework***. Make sure that the agent making the decision is aware of the utility measures, defined risk and the aspiration level of decision. Define the control and evaluation process accordingly. (See Agent Theory and the Interpretivist Model in point 5.)

f. ***Determine Courses of Action.*** Define all possible courses of actions that address completely the problem at hand.

g. ***Reduce Uncertainty.*** Use all appropriate means to reduce uncertainty to acceptable levels. (See Information Processing Model in point 5.)

h. ***Evaluate Risk.*** Define a model to assess the probability of adverse outcomes and their impact. Define a method to deal with the "unknown unknowns".

i. ***Find Possible Solutions***. Determine what courses of action provide valid solutions and satisfy the level of aspiration previously defined. If more than one solution satisfy the criteria, leave the options open until all other decisions are analyzed. If no solution is found, the options are:

- Relax the aspiration level
- Assign more resources to the decision making process
- Relax one or more of the existing constraints

D. SUMMARY

This chapter describes the circumstances under which the case takes place, and the theoretical framework that will sustain the analysis. The framework describes the characteristics of a contract, the risks involved in contracting, and theoretical models that can help to evaluate the organizations involved and behavior of the actors involved in the case. It also provides a method for decision making under risk.

The next chapter will present the case itself, starting with the decision that initiated the project, followed by the source selection, negotiation and contracting and finishing with the events after the contract until the system was fielded.

III. THE CASE

A. GENESIS OF THE PROJECT

In October 1984 the Commander in Chief of the Navy directed several studies to shape the policy for the Navy in the years to come. It was clear that the politico-strategic circumstances demanded profound changes, and the time was appropriate.

Among those studies, the Fleet Repowering Study[18] referred to the enhancement of the capabilities of the fleet to cope with the expected threats. The Falklands war provided valuable lessons and exposed certain vulnerabilities that needed to be dealt with. The result of that study showed the need to acquire a specific capability for the fleet. The Commander in Chief of the Navy created Project Kilo[19], and put it under the Naval Weapons Directory. Figure 3.1 shows the initial organization of Project Kilo.

B. SOURCE EXPLORATION

Beginning with the Fleet Repowering Study, a board composed of four Admirals, representing the Fleet, the Logistics Directorate, the Naval Weapons Directory and the Commander in Chief Staff studied the different options available to provide the required capabilities. The Project Manager provided the technical data, information about potential contractors, and analyses of performance and suitability of the different options.

The board determined that the best solution was the use of a specific type of missile. The Project team identified two potential sources for the missile system. One of them named BLAST II, manufactured by an experienced aeronautical-electronics private group, which was already deployed in its country of origin. The other, ALPHA I, was under development by a highly experienced group of industries owned by their government.

---

[18] Estudio de Repotenciamiento de la Escuadra, Estado Mayor General de la Armada, 1985.

[19] As mentioned in the first Chapter, some names, dates and quantities have been omitted or changed for security reasons. Alpha aeronautics of country Omega and BLAST are fictitious names of actual companies.

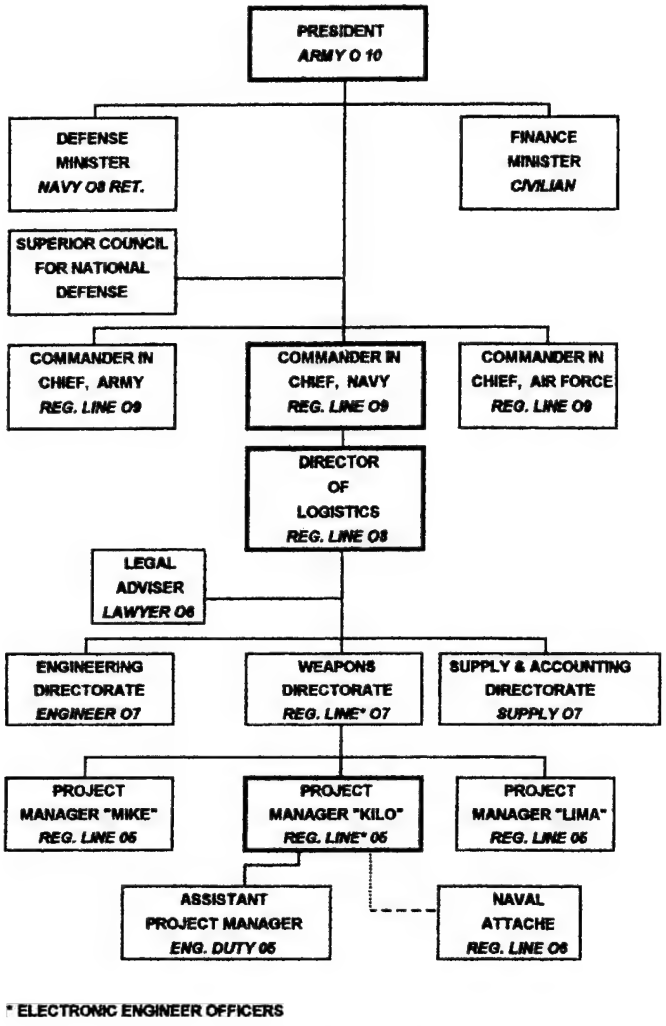


Figure 3.1 Project Kilo Initial Organization

C. THE SELECTION PROCESS

After a first round of contacts, negotiations and analysis, the project team obtained proposals from both companies. The proposals specified the performance of the systems, the price and the delivery schedule. As expected, the performance of both systems was equivalent, the promised delivery schedule for the BLAST II system was slightly shorter than the other, and the cost of the ALPHA I system was about half of the other.

At that point, there was clear awareness of the risk involved in each of the proposals, especially in the case of ALPHA I. The system was just in the development phase of the first version, although a prototype test had shown very promising results. It was also considered

that the degree of maturity was closely related to the risk of obsolescence. While BLAST II was soon to be replaced by a new version, ALPHA I was just being fielded. Table 3.1 compares the main characteristics of the two proposals.

	MATURE SYSTEM (BLAST II)	DEVELOPING SYSTEM (ALPHA I)
COST	US$ 200 Million	US$ 110 Million
PERFORMANCE	Equivalent.	Equivalent.
SCHEDULE	Four Years.	Five Years.
RISK	Low, upgrade of a deployed system.	High, first version under development.
PAST EXPERIENCE	Good past experience with government in performance and negotiation.	Good past experience with government in performance. Difficult to negotiate with them

Table 3.1 Comparison Between the Two Systems Offered

The Project Manager (an Electronic Engineer Commander) prepared the data and briefed the board of Admirals on the characteristics of the offers. After a series of meetings with the board, they were ready to present a plan to the Commander in Chief, including the choice of supplier, quantity of systems, and the budgetary framework. The decision was discussed in terms of risk versus price. Considering that there were no short term threats, the risk of waiting more than the promised schedule was considered acceptable as a condition to get more systems for the same amount of money, and even more if late fees could be renegotiated and traded for increases in quantity.

Finally, ALPHA I, referred to later as the "Kilo Missile System," was selected. The systems, once available, were going to be more effective on a collective basis (more units). If delays occurred, the Navy could bargain for lower price, increased quantities, or for improved features as a compensation. The decision was approved by the Commander in Chief for final approval before committing to a contract.

D. THE NEGOTIATION

Once the decision was approved by the Commander in Chief, the Project Manager approached Alpha authorities to set the conditions of the contract. Alpha was the aeronautic consortium owned by Omega Government, which would coordinate the efforts of itself and the other two government owned companies in the fulfillment of the contract.

1. First Approaches

The Project Manager, with the help of the lawyer of the Director General of Logistics, created the first draft of the contract. It established the final performance of the system, a delivery schedule, and a system of late fees for eventual delays. ALPHA reviewed the contract, and proposed a new one.

2. Negotiation Issues

The counter proposal of ALPHA set the agenda for the discussions to follow, including the following issues:

a. Late Fees. ALPHA proposal included a very soft arrangement for late fees, and clauses that freed ALPHA from responsibilities in several situations (Force Majeure). The negotiations to arrive to a definitive contract, conducted by the Project Manager, lasted more than six months. Meetings were held in Chile and country Omega, and every single clause was strongly discussed. The Project Manager was especially concerned about the capacity to deliver on time, and the mechanisms to compensate if delays occurred. The Chilean Navy knew that delays could occur, and wanted to have enough bargaining power to limit those delays and to take advantage of them, so the limited late fees were not at all satisfactory.

b. Performance Test and Evaluation. There was concern about the detailed specifications and test procedures. The expected general performance was clear, but changes could occur during the development, as well as the details of installation and integration. It was also expected that the development could provide opportunities for improvements above the specified features, but the Chilean Navy did not want to become captive of an offer impossible to reject and hence quite expensive to afford.

c. ***Risk Sharing***. From the beginning the contract was negotiated as a firm fixed price type. The option of a cost plus contract was not even mentioned, and it was not available either since there was no permanent access to the cost management structure of Alpha. Even the access of Chilean Navy inspectors for quality assurance and coordination was not accepted easily by Alpha negotiators, since they had classified commitments with their government and third countries also.

Alpha officials were concerned about exogenous variables, like monetary changes, interest rates and labor costs. Also, they were not willing to accept indefinite late fees that could take away all their profits or even create a loss.

d. ***Enforceability.*** Another concern was the enforceability of the contract. If it was signed in the jurisdiction of either of the two parties, the other would be at a disadvantage. Even if a third party were selected, a scenario of termination for contract breach was not acceptable for either party. This meant that a negotiated solution was to be found in such event, so enough bargaining power and backing instruments were necessary.

e. ***Financial Arrangements***. Alpha wanted a significant payment up front (60%) and progress payments as partial deliveries were certified. The Chilean Navy had not enough cash availability to pay according to that schema, but could commit resources in the long term if there was certainty of the payment schedule. The Project Manager identified the dependence from ALPHA for financing as a major limitation in his bargaining power.

f. ***Asymmetric Information***. Finally there was an issue of asymmetric information. Omega government and ALPHA knew that the project was a high priority for the Chilean Navy, and that the resources were committed by the Chilean Government. The Chilean Navy however had no way to assess the real capacity and commitment of ALPHA and Omega government to deliver the system. The only clue was that Omega Navy was already involved in the development, although they had not signed a contract yet for the production of the system.

E. THE CONTRACT

The culmination of the negotiation process was the Contract enclosed as Appendix A. The Contract had two parts:

- The main agreement, for the supply of the weapon system and the payment according to the schema proposed by Alpha

- A financial agreement, which reconciles the payment schema of the main agreement with the cash flows available by the Chilean Navy. The difference between the two was covered by a loan with a floating rate interest

The mechanisms devised to overcome the issues mentioned before are explained in the following points.

1. Delivery Uncertainty

Delivery lots were defined as packages of hardware tested and accepted by Chilean Navy inspectors in Alpha facilities. For the installation and integration phases (considered only for the first unit) other adhoc milestones were agreed. Late fees were established as a 0.5% of the value of the package per month, with a maximum of 6% (Article 7). Fees were to be charged after a period of grace of 90 days (120 days for the first lot). In case of a delay beyond 12 months on a specific subsystem/unit the Chilean Navy had the right to terminate the contract for that specific subsystem/unit (Article 9.1).

2. Detailed Specifications, Test and Improvements

For the most part, the technical specifications were a description of the system and its components, how they related to each other, and what interactions were to be between the system and the existing systems on board, including fire control, C^3I and other weapons systems. The performance specifications included in the contract were most (but not all) of those contained in the offer made by ALPHA. Among those not included in the contract, the most important was the assertion that the system was completely developed and tested for the Navy of OMEGA, which was far from reality. Instead, a tentative program was established. Other aspects on performance were stated in the negotiations but not in the formal offer. It was stated in the contract (Article 2.2) that manufacturing, assembly, training and documentation standards and practices would be those applied for the OMEGA Navy.

ALPHA had to submit detailed specification and test procedures for approval by Chilean Navy inspectors six months prior to a Factory Acceptance Test. In case of disagreement, Omega Navy technical authorities would arbitrate. If any improvement was

introduced to the system being developed to Omega Navy, ALPHA had to notify the Chilean Navy and make the modifications available, subject to approval by the Defense Authority (Article 14.1.2).

3. Enforceability and Bargaining Power

The contract was signed under the law of the State of New York (Article 18), to provide neutral grounds. A mechanism for arbitration was also established under the rules of the International Chamber of Commerce (Article 13). One problem not appreciated when the contract was signed was that not all of the deliveries were attached to monetary value. Documents like detailed specifications and requirements were included in lots with due dates but without price, so late fees were not applicable. Besides, the mechanisms to charge the late fees were not clearly stated. The maximum late fees that the Chilean Navy could collect were less than two million dollars in a contract of over one hundred million.

Bargaining power for the Chilean Navy was strengthened with the partial termination clause (Article 9.1), that allowed the Chilean Navy to terminate the contract for a specific subsystem or unit if delayed for over a year. In such case, the Chilean Navy could go for a competing contractor or in-house activity to provide that subsystem, while the rest of the contract would follow normally. This clause would hardly be invoked, but the consequences were very strong for ALPHA.

The contract was backed by a letter of credit for the full amount of the contract for the case of eventual non-compliance. The letter of credit was held by a bank in country Omega.

4. Financial Agreement

The difference between the cash flow required for payment and the availability of funds was bridged by a separate financial agreement, already mentioned. The rate of interest was established at a floating rate of LIBOR plus 1.5%. According to the structure of payments considering in the main agreement and the delivery schedule, the Chilean Navy would have a debt between 50 and 60 million dollars from the fourth to the eighth year of the contract.

5. Asymmetry of Information

The lack of information about the commitment of ALPHA and their technical capacity was mitigated somehow by involving Omega Navy as a technical arbitrator. Although ALPHA belongs to Omega government, it was expected that Omega Navy would play more as a customer of ALPHA, sitting at the same side of the table with the Chilean Navy if a conflict arose.

The access of inspectors to ALPHA facilities, their presence in developmental testing, and the obligation of ALPHA to submit information about the advance and achievements of that development was included also in the contract to increase the level of information to the Chilean Navy.

Other than the mentioned measures, asymmetry was still a complex issue. No one in the Chilean Navy team spoke Omega's language, and Omega officials were extremely reserved. Commitment was not only unknown, but also variable. Omega Navy was still negotiating with ALPHA and its legislature to reach an agreement for production, and the international scenario was unstable enough to force ALPHA to suspend project Kilo temporarily and give higher priority to other projects for Omega Government.

F. AFTER THE CONTRACT

The signature of the contract marked the end of an intense negotiation process, and the beginning of a difficult relationship between the Chilean Navy and ALPHA. The following points describe the events and issues during the period from the signature of the contract until the present time, when the first system is undergoing final tests at sea.

1. Organization

Until one year after the signature of the contract, the Project Manager was still on a collateral duty basis, and had other responsibilities at the Naval Weapon Directory. Three other projects related to the repowering of the fleet were all handled in the same way. Given the relevance of these projects, the Commander in Chief of the Navy appointed an admiral with exclusive dedication to them, now grouped under the name of "Program Horizon". Now all four Project Managers would have full time dedication to their projects.

Horizon Program Director was an admiral renowned for his character, technical knowledge, and versatility. He designed a Program Office with no precedent in the Navy. All project managers were on the same floor of his office, and could reach him at any time, not to discuss problems but rather to brief him about solutions and decisions already taken. Basically, he led the team through example and veto power. Under him, but not in the line, two commanders were appointed as Program Coordinator and Financial Officer. The Program Coordinator helped the Project Managers to plan the activities for the same ships, avoiding interferences and duplication of efforts. The Financial Officer handled the accounts of all four projects, keeping better control and accuracy.

The Program Director backed personally the Project Managers in the most important negotiations in the projects, and handled situations like those described in this case with great flexibility and imagination. In his favor, this Program Director had more autonomy than any other admiral in the Navy. His projects were prestigious, the Navy was one hundred percent committed, and the government would not interfere with them.

Naval officers and enlisted specialists were not accustomed to a business environment and the relationships with a contractor like ALPHA. Deals were not clear-cut, statements made verbally would be denied or ignored if the paper said something different, and the contractor would try to blame the customer for any delay or unfulfillment of an obligation. Successive Project Managers had to overcome their frustrations and inexperience to keep negotiations going and the project advancing. Both of the regular line commanders specialized in electronic engineering and weapons engineering were carefully selected by their competence. However, they had no business experience, and were fully responsible for the project. Learning was intense and fruitful, but painful, according to their on accounts.

2. Activities in Country Omega

Two years after the signature of the contract, Omega country appointed a Technical Inspector Office to inspect the development tests and to certify the delivery tests. Two years later, the Chilean Navy sent three officers and thirty enlisted men to Alpha premises for training in installation and maintenance.

This group of people gained valuable experience, but due to the delays, most of them would not be the actual operators and maintainers of the systems once fielded. The training was later repeated in Chile for the actual crews.

3. Delays and Renegotiations

Clear signs of delays became apparent three years after the signature of the contract. ALPHA reported that most of the components of the first lot would be delivered two months late. Presentation of the lot for Factory Acceptance Test (FAT) was eleven months late, and some of the units did not receive complete operational testing. The detailed specifications submitted by ALPHA before the test were merely a copy of those included in the contract. The software that controlled the system was not included at all, and operational tests were to be conducted with a developmental software. As the Chilean Navy refused to accept the items, ALPHA offered to submit them eight months later, but with improved features included for the Omega Navy version.

Since the Chilean Navy viewed the proposed modifications as satisfactory under the circumstances, but far from the schedule of the contract, the Addendum No.2[20] was agreed to update the schedule, to include the new features in exchange for the delays, and to provide a separate description and delivery schedule for the software. Throughout the period after Amendment No.2 new delays and difficulties to conduct meaningful tests were experienced. A military crisis caused a work stoppage for a four-month period. The contract was amended three times after the second already mentioned. In each of those amendments, the main issue was the renegotiation of the delivery schedule.

4. Installation and Integration

The main difficulties were found not surprisingly in the integration phase, to a point that delivered items were not put to work for more than 18 months, the expiration period for the warranty. Successive delays in the software, failures of the diagnostic system, and difficulties in the communication protocols between the existing and the new systems delayed the end of the integration of the first system three years after the scheduled date.

---

[20] Amendment No. 1 was an increase in the number of missiles to be acquired.

These delays had an adverse effect on the Chilean Naval planning, since the ship to receive the system was held in the shipyard longer than expected outside the planned retrofit period. The planned retrofit periods were coordinated with the general refit of several other ships, a task involving millions of dollars in the structure of the ships and all its systems. Other projects were also tied to these down periods. The result was an over-expenditure in the maintenance budget, and the loss of several warranties in the other related projects.

Another effect, more subtle but not less important, was that the extended period caused changes in the project managers of project Kilo and others to be materialized in the same ships, with loss of continuity and skills acquired through learning. The Program Horizon ameliorated this effect appointing Project Managers with previous experience in the project as plant representatives.

All of these problems and discontinuities amounted to a deterioration of the relationships between the Chilean Navy and ALPHA. Each disruption was followed by a period of harsh negotiations. ALPHA exploited any subtle weakness of the contract and any administrative mistake of the unexperienced and undermanned Chilean Navy team.

5. Current Situation

The first system was installed satisfactorily on board four years after the contract schedule date. The system required some fine tuning yet to reach the full performance expected, and software is still being debugged and documented. The system passed all of the Harbor Acceptance Trials, and has recently begun the Sea Acceptance Trials. Those tests will include firing one missile. The second system is being installed, and all materials and components for all the systems are in place at a Chilean Navy supply center.

The experience gained with the first system allowed the Navy the convenience of extending the participation of ALPHA to the installation and integration of a second ship, a process which is still in progress. The extension in ALPHA's participation was included at no cost in the fourth amendment of the contract, as a compensation for rescheduling the deliveries.

The price of the project has not changed throughout this process. Improvements in performance and ALPHA's participation in installation and integration work have been

exchanged for late fees. Other savings have been realized in interests. The schedule of payments of the finance agreement became closer to the payments due in the main agreement, thus reducing the debt level, and the LIBOR rate has been lower than the expected. Total savings amount to nine percent of the expected outlays.

In summary, the Chilean Navy is getting a leading edge missile system, below budgeted cost, within performance baseline, but four years behind schedule. Costs incurred in the maintenance budget for changes in planned refit periods, warranty coverage loss, and other delay-related costs not included in the Project have not been computed.

6. Projections for the Future

What will happen with the second and third systems remains to be seen, but the learning process should help to keep the program up to speed.

Although the original Project Manager and Program Director are no longer in the program, they remain in the Navy pursuing successful careers, which is a measure of success as perceived by Navy authorities. They maintain influence over the project from their current positions, contributing to its stability.

G. SUMMARY

This third chapter describes the relevant events of this case, from the decision that started the project, through the negotiation and design of the contract, to its implementation. The project remains active, but the accumulated experience is rich enough for lessons to be learned.

The next chapter contains the case analysis. The issues related to the procurement, and particularly the contract, are addressed based on the events just described and the theory foundations laid down in Chapter II.

IV. ANALYSIS

A. GENERAL

The previous Chapter describes the Project Kilo case, from the decision to procure the "Kilo" ship missile system through the source selection, negotiation, contracting, manufacturing and fielding of the system. This Chapter shows the analysis of the case, using the information available in Chapters II and III, and the theoretical framework explained in Chapter II.

1. Outline of the Analysis

The analysis identifies the challenges and constraints for Project Kilo, and then examines them from different perspectives with the following outline:

a. General Challenges and Constraints Faced by the Chilean Navy when Procuring Weapon Systems

In this section, the challenges and constraints facing any weapon system procurement are identified, as of the period from 1985 to 1988. They include general challenges, political-economic constraints, and technical constraints.

b. Specific Challenges and Constraints for the Procurement of the Kilo Missile System

This section will describe the elements that made the challenges for Project Kilo different from those described in the preceding point, including which challenges and constraints were not particularly relevant, and what new challenges arose. It will also explore the negotiation position of the parties and the sources of risk for Project Kilo.

c. Response of the Project Team to the General and Specific Challenges and Constraints

This section will show how the Project Team handled the previously identified challenges and constraints, and will cover the following issues:

(1) Organization and Manning for the Task. Project Kilo organization will be compared to the typical business organization for projects and to the typical U.S. Program Management organization. The models presented in Chapter II, including the Information Processing Model, Interpretivist Model and Agency Theory will

be used also to analyze the organization of Project Kilo.

*(2) **Uncertainty and Risk Handling.*** The different elements of risk for Project Kilo will be assessed, and also the measures taken by the Project Team to handle that risk, including:

- Procurement Risk: cost, schedule and performance
- After Sales Support Risk: logistic and technical support
- Political Risk: government and Navy commitment for the project, and political support in contractor's country

*(3) **Contract Negotiation.*** How the project Team interacted with the seller to generate the appropriate conditions and relationships necessary for the success of the procurement will be analyzed.

*(4) **Non-Contractual Means Used:*** What other means were used as leverage in the negotiation process will be identified and evaluated.

d. Relationship Between the Results of the Project and the Previous Analysis

The actual results of the procurement are compared to the expected results.

e. Lessons Learned and Implications for Future Procurement

This section summarizes the findings of the analysis, in terms of what actions or situations were relevant for the outcome of Project Kilo, and what conditions could be improved to diminish the risk or improve the results of future procurements.

B. GENERAL CHALLENGES AND CONSTRAINTS FACED BY THE CHILEAN NAVY WHEN PROCURING WEAPON SYSTEMS

1. Major Challenges

The following are the major general challenges applicable to any weapon system procurement made by the Chilean Navy, as they were seen in the late Eighties.

a. Acquiring Effective Weapons Without a Technology Base

The major challenge faced by the Chilean Navy when procuring a major weapon system is the need to obtain leading edge equipment without possessing its own technology base, and with severe resource constraints. The Navy must keep control of an

enormous maritime territory and maintain a credible deterrence against the threat of aggressive neighbors with four times Chile's population and financial resources. Those nations already had better and newer weapons, capable of causing severe damage to the Chilean Fleet.

b. Deciding the Appropriate Degree of Maturity of Technology

The Navy must achieve a high effectiveness-to-cost ratio, and possess weapon systems able to deal with current and future threats. When selecting a weapon system to deal with a set of threats or missions, the main choices are buying the best system in the marketplace at a premium price, or buying systems in development stage with higher risk and lower price. Another consideration is that mature systems are often very close to obsolescence.

c. Determining the Appropriate Degree of National Participation

Secondary choices are the various degrees of national participation, from high risk co-development to low risk turnkey procurement. Risk and price are always a subject of tradeoff, but national participation can be part of a strategy that goes beyond the particular procurement goals.

d. High Impact of Failure

Since major projects are infrequent, each of them has a decisive impact on defense capabilities. A failure will create a serious shortcoming in the desired level of deterrence. For that reason the Navy keeps these projects in a high level of secrecy. High secrecy implies that the project has to be handled only with in-house expertise, making difficult the possibility of hiring external consultants.

e. Project Manager Rotation

Procurement projects usually take more than ten years, but Project Managers cannot stay more than three years on the job if they are to follow a regular line career path. As a result, as many as five different Project Managers may participate in one procurement effort, as do higher authorities dealing with the project. Rotation makes learning and experience building difficult, while communications between the Navy and the contractors are stressed by changing management styles, goals and policies.

f. Lack of Experience and Information

Chile does not have a developed industrial base, so every procurement has a major foreign component. Consequently, contracts are usually between the Navy and governments or industries of other countries. Foreign weapon systems producers have much more experience in negotiation and contracting than the Chilean Navy has. Those companies also have a base of technical, business and cost information that is not accessible by the Chilean Navy. Low in-house experience due to the low frequency of major contracts makes the asymmetry of experience and information a large and unavoidable challenge.

g. Maintaining Political Support

All procurement projects must be supported by the service and a critical mass of political authorities to keep the commitment in the long term. Although the Chilean Navy has a great deal of autonomy, a commitment for ten years or more requires more than just Navy support. Even within the Navy, there might be competing demands for resources in the form of other projects, operational requirements or social demands. A project that progresses smoothly is not challenged, but if the events depart from the expected, those competing demands will see an opportunity to obtain the resources originally assigned for the project. In international contracts, political support on the side of the seller is also required to ensure the delivery of the system without interference.

h. Multiplicity of actors and goals

Another challenge is the multiplicity of actors striving for different goals. The complex environment in which the Project Manager is inserted is described in Chapter II. Each actor sees the project from a different perspective, and the measure of success for each of them will differ. Some elements of success might converge, such as the delivery of the system within acceptable time, schedule and performance limits. Others elements, such as profit, cost, risk sharing, and influence, will diverge.

i. Need for Communication and Negotiation Skills

The Project Manager needs to understand this complex interaction of interests. From this understanding he must create an environment where the customer gets its weapon system while all the other actors achieve their goals. The problem is that these

competing interests might be not compatible, thus compromising and negotiation come into play. The challenge for the Project Manager and his superiors is to create the conditions and get the necessary skills to communicate and negotiate successfully with all the stakeholders. Getting support from upper level authorities is a constant challenge for the Project Manager, especially when those authorities rotate as often as he does. The Project Manager must be his project's salesman.

2. Political and Economic Constraints

Apart from the mentioned challenges, the Chilean Navy faces certain constraints that limit its capacity to obtain the desired solutions.

a. Political Environment

The Chilean Navy is subject to the Chilean political and economic system. As mentioned in Chapter II, the Navy has relative autonomy to define its needs and to commit resources in the long term, but those resources are limited. The autonomy enjoyed by the Navy was likely to change within the time-frame of the project. A transition to full democracy was to begin in 1989, and the political changes would affect the budgetary autonomy of the Armed Forces.

b. Scarce Resources

The Chilean annual defense budget is close to one billion dollars. Those resources are tied to the success of copper exports. About 25% of the budget can be devoted to procurement, divided evenly among the three services. This means that the Navy has about 60 million dollars per year to satisfy all procurement needs.

The immediate consequence of that economic limitation is that no more than three major projects can be executed simultaneously, and therefore the base of experience and organizational stability for procurement is relatively weak. All program managers for major weapon system acquisition are in that position for the first and only time in their career.

c. Need for External Financing

Another consequence of this low flow of resources is that projects are paid in installments over a long time. The contractor usually provides the financing, resulting in

a long term relationship. The contractor who provides financial support gets a great advantage when it comes to set the conditions of the contract.

d. Lack of Cost and Pricing Data

Another constraint is the lack of experience in dealing with costs in the acquisition of missile systems. When the U.S. services procure a new weapon system, the program team has abundant data about cost of similar systems. The regulations about cost and pricing data[21] force the contractors to provide accurate and detailed data about cost. Defense Plant Representative Officers and Administrative Contracting Officers have access to the information and processes in the contractor's plant. Cost Accounting Standards help the government representatives to obtain accurate costing data.

The Chilean Navy has no access to costing data nor legal authority to enforce accounting standards of any kind in foreign countries. There is no cost data on previous similar systems, since the Chilean government has no recent experience with similar weapon systems, whatever they might be. The only solution is dealing with the market, and obtaining prices from different sources, although the sources for equivalent systems are few. An independent cost estimation using data from open sources in the U.S. or other countries could help, but that estimation requires education and training, or must be hired as consulting services.

3. Technical Constraints

Technical constraints are not as severe as the economic ones, but they are more subtle. The Chilean Navy has highly educated technical officers and enlisted personnel, and historically has been able to keep up with new technologies. However, new characteristics of technology creates new and different constraints.

a. Structure of Technology

How technology is structured in new systems tends to make it invisible to the users. Highly concentrated electronic circuits cannot be understood without the help of

---

[21] The Truth in Negotiation Act, as reformed by the Federal Acquisition Streamlining Act of 1994, requires cost and pricing data for all contracts over US$ 500,000.

diagnosis and descriptive software, and dealing with software requires an expertise that cannot be acquired in the classroom. New materials cannot be tested and less reproduced without expensive specialized metallurgical laboratories. New technology requires proprietary information that creates a dependence from the provider.

b. Technology Transfer

Acquiring technology now not only requires purchasing the appropriate equipment, but also the documentation, software, training and technology transfer means. Determining how much of it is necessary, how much it is worth, and how much is the provider willing to transfer requires experience and technical skills. On the other hand, convincing the authorities that funding for these "soft" goods is indispensable is another challenge for the Project Manager.

4. Immaturity of Contract Management Regulations

The difficulties found in project management were analyzed in the early Eighties. An important effort was made by the General Director for Logistics to improve project management. The result of that effort was the Navy Project Handbook[22], which included a well defined decision/approval path from the generation of an idea through the materialization of it. Financial control and progress reporting were also standardized. However, the particulars of contracting were not included, and the related legal regulations (already mentioned in Chapter II) were dispersed across a set of laws and regulations. This situation was a reflection of the past history of the Chilean Navy, which had just begun to procure major weapon systems independently after a long period when weapon system procurement was made through government to government cooperation agreements and second hand ship acquisitions.

5. Summary of General Challenges and Constraints

In summary, fifteen general challenges and constraints faced by the Chilean Navy when procuring weapon systems have been identified:

---

[22] Manual de Proyectos de la Armada, Reglamento Reservado 5-41/1-03, 1985.

1. Acquiring Effective Weapons Without a Technology Base
2. Determining the Appropriate Maturity of Technology
3. Determining Degree of National Participation
4. High Impact of Failure
5. Project Manager Rotation
6. Lack of Experience and Information
7. Maintaining Political Support
8. Multiplicity of Actors and Goals
9. Need for Communication and Negotiation Skills
10. Scarce Resources; Few Major Projects
11. Need for External Financing
12. Lack of Cost and Pricing Data
13. Structure of Technology
14. Difficulty of Technology Transfer
15. Immaturity of Contract Management Regulations

C. SPECIFIC CHALLENGES AND CONSTRAINTS FOR THE PROCUREMENT OF THE KILO MISSILE SYSTEM

Project Kilo presented the challenge of being the first new major weapon system acquisition in the last sixty years. The system was not fully developed, so uncertainty and risk were the dominant factors. This section describes the particular characteristics of Project Kilo, which created some different challenges and constraints as compared to the general ones just described.

1. Difference between the general challenges and those specific to Project Kilo

a. Organizational Stability

Some of the fifteen factors mentioned in the general challenges and constraints were not particularly relevant for this project. Given the importance of the program, the Program Director was given ample authority, and he also gave enough authority to the Project Manager to handle his project. During the evolution of the project, the

organization evolved to become the first one dedicated entirely to procurement projects. Project Managers stayed for an average of five years in the project, starting as plant representatives before taking the Project Manager position.

b. Financing and Political Support

The Navy was committed to Project Kilo for the long term. It was expected that Kilo and the other projects of Program Horizon would be the key to update the capabilities of the fleet for a long period. The projects were designed to be paid with the procurement funds of the following ten years, so that top level decision makers would not face new procurement decisions until well beyond the political transition.

c. Different Culture

An unusual challenge for Project Kilo was the need to deal with a different culture. For a long time Chile had dealt with the U.S. and UK for most of its foreign business, but now they had to deal with Omegan culture. It was not just a matter of language, but also a different way to conduct business.

d. Summary of Different Challenges

Accordingly, three of the fifteen previously mentioned challenges were not particularly relevant in Project Kilo:

- Multiplicity of Actors and Goals
- Maintaining Political Support
- Program Manager Rotation

And a new factor, in addition to the fifteen general challenges, was identified:

- Different culture, including business references, language and ethical standards

2. Negotiation Position of the Parties

The Chilean Navy had to negotiate with ALPHA officials, who were more experienced in international business. Both parties had different goals and different strengths to exploit during the negotiations.

a. Position of the Contractor

Alpha had proprietary information about the characteristics and degree of development of the system. For them, having an external source of financing and a free test bed for its new weapon system was a worthy benefit to seek from the project, despite its relative or absolute success. They were trying to ensure Omega Navy commitment, and the Chilean Navy contract would help to obtain that commitment. Sharing development cost with an external customer, and having the chance to test the system under another customer's scrutiny would make the procurement more convenient for Omega Navy.

b. Position of the Buyer

For the Chilean Navy, the success of the project within its financial limits was crucial for the future strength of the Navy. The only leverage that the Chilean Navy had over ALPHA was the prospect of a long term relationship with a loyal customer, and other potential customers. ALPHA had performed well so far in other Chilean government projects. If the Chilean Navy had become disappointed with ALPHA, Navy authorities would look for another provider the next time. Other potential customers would look at the Chilean experience very carefully. But the Chilean Navy would not be willing to publicize a failure, so ALPHA's risk was not so apparent.

The negotiation position of the Chilean Navy was enhanced by putting two highly qualified officers in the Project Manager team, having strong technical expertise, English language fluency and personal attributes appropriate to deal with the challenges.

3. Sources of Risk

Although risk is analyzed in detail on part D.2. of this chapter, its sources are part of the context being described in this section of the analysis. What created risks in terms of cost, schedule and performance is described as follows:

a. Cost Risk

Although the contract was a Firm Fixed Price type, cost risks did exist. A variety of events, mentioned in Chapter II, can modify the final price of a fixed price contract. In addition, interest rates in the financial agreement and exogenous factors included in the price adjustment formula were added to the cost risks of the Chilean Navy.

b. Performance Risk

This risk was a consequence of the early development stage of the system, and the uncertainty about the real possibilities and commitment of ALPHA. In a worst case, ALPHA might not be able to produce the system at all.

c. Schedule risk

This risk was a different face of the same phenomenon. If the chances for a successful system were farther away than what ALPHA claimed, only more time would allow ALPHA to produce the system. Concurrence was another source of risk. The stage in which the contract was negotiated was equivalent to Engineering and Manufacturing Development. A single contract provided for the completion of this stage, production and after production support, which made the schedule vulnerable to single failures in developmental activities.

D. RESPONSE OF THE CONTRACTING TEAM TO THE GENERAL AND SPECIFIC CHALLENGES AND CONSTRAINTS

According to the challenges and sources of risk already mentioned, the Navy Negotiating team would need to:

- find out if ALPHA was really able to produce the system with the alleged performance within a reasonable time;
- create the conditions to commit ALPHA to the success of the project;
- identify the risks of failure, and create the conditions to avoid or, in a worst case, remedy the consequences of those risks.

1. Organization and Manning for the Task

In this section, the analysis shows how the Navy designed and modified the organization to perform its task. The Chilean Navy's organization is compared to the U.S. Navy typical Program Manager organization and also to a typical private business organization dealing with contracts comparable to a weapon system acquisition.

Although the organization of the Program Director and Project Manager started such as that of any other Project in the Chilean Navy at the time, it evolved to become unique, according to the challenges presented by this procurement. During the critical phase of

negotiation, the Project Team was composed by the Project Manager, an O5 specialist in Electronic Engineering and another O5 specialist in missiles and ordinance. Two years after the contract began, Project Kilo took its definitive shape under Program Horizon, obtaining full time dedication and adding the Plant Representative. The diagram shown in figure 4.1 shows the organization of Project Kilo under Program Horizon.

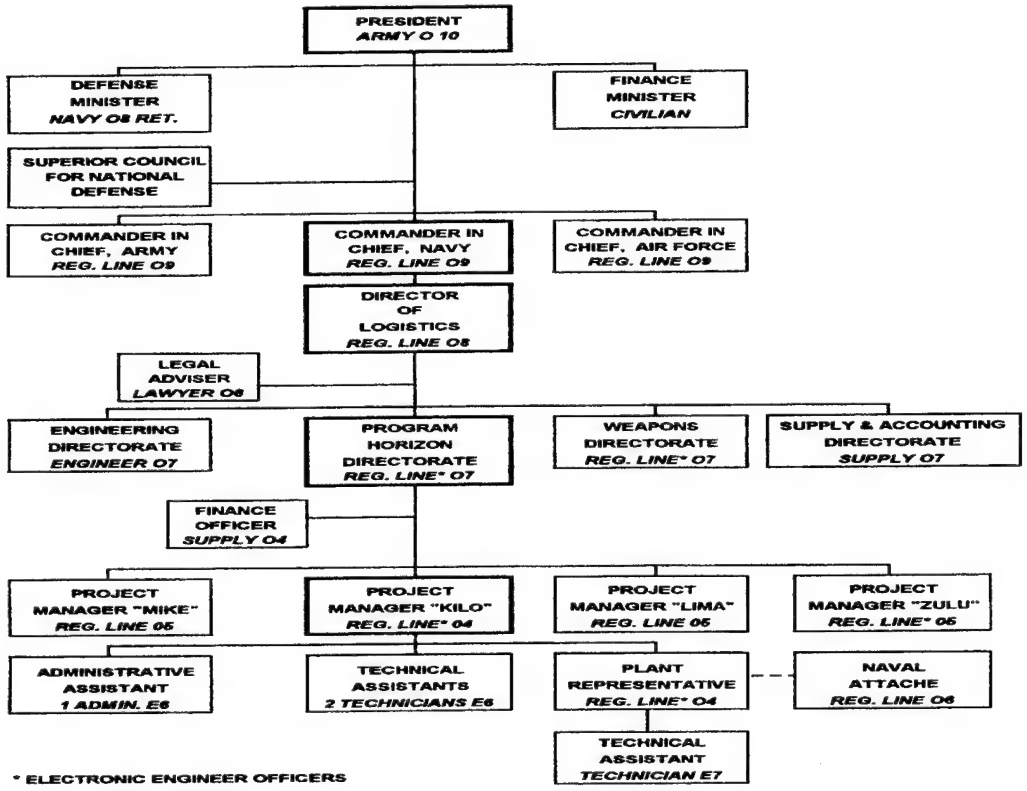
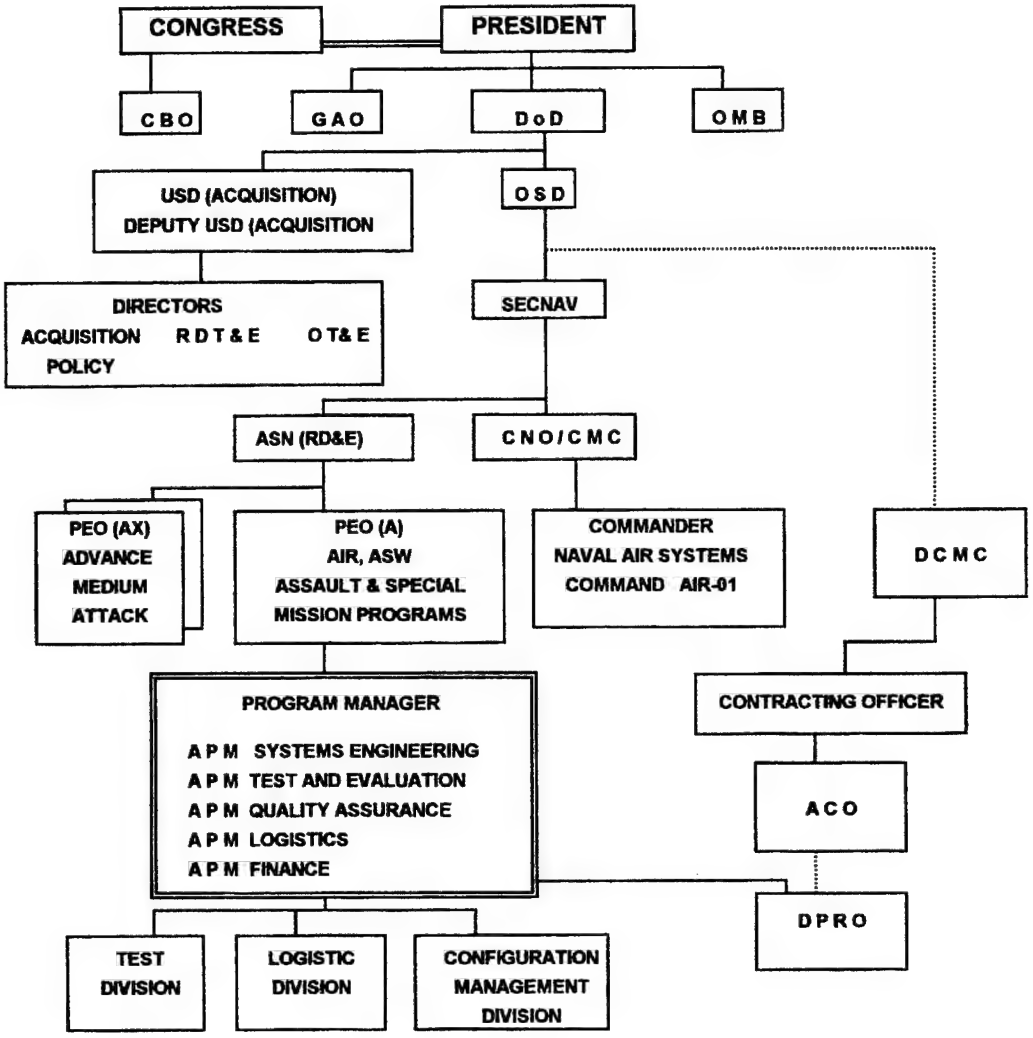


Figure 4.1 Organization of Project Kilo under Program Horizon

a. *Comparison of Project Kilo to DoD and Private Business Organizations*

Compared to the U.S. organization, project Kilo is much smaller, lacking most of the specialized staff and external support in areas such as Test and Evaluation, Logistics, Contracting, Systems Engineering, Finance, Quality Assurance and Cost Estimation. All these responsibilities lay over the Project Manager and the Plant Representative. Figure 4.2 shows a typical U.S. DoD Program manager organization.



SOURCES:

STRATEGIC PLANNING AND POLICY FOR LOGISTICS MANAGERS, STUDENTS GUIDE, JULY 1995
SYSTEM ACQUISITION AND PROGRAM MANAGEMENT, MN 3301, READINGS BOOK 1994.
JOINT ACADEMIC LOGISTIC MANAGEMENT EVALUATION, CONFERENCE BY CDR (S) TOM HAMMAN, AUG 3 1995

Figure 4.2 Typical Organization of a DoD Program Manager Office

Compared to the typical private business organization, the size of Project Kilo organization is about the same, but the private business organization has better expertise in business and legal aspects. For quality assurance, many private businesses use external certification companies, which was not feasible for project Kilo. Another critical difference is the number of layers of reporting authority. In a private business, the Project Manager reports directly to the CEO or a Vice president. In the Navy, there are three layers over the

Project Manager just within the Navy. At least two more may intervene at the political level. Figure 4.3 shows a typical private business project organization, as described in the interviews with Professor Mark Stone and executives of ARGO Systems.

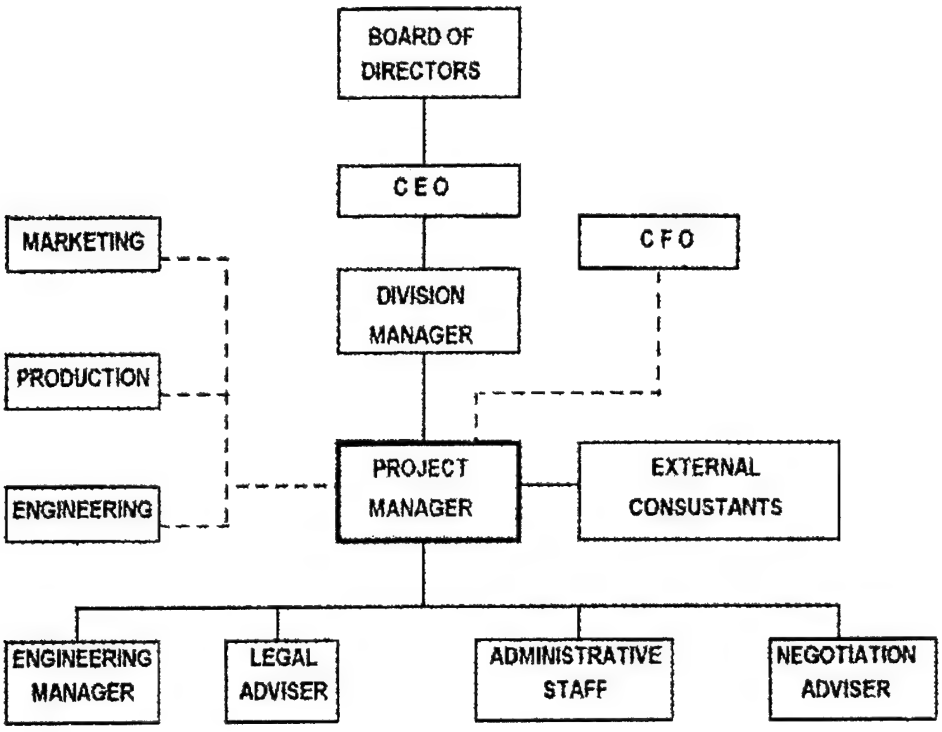


Figure 4.3 Typical Organization of a Private Project Manager Office

b. Agency Theory

When the project began, the Project Manager was the only agent of the Navy interacting with the suppliers. The Program Director had multiple commitments, so all negotiations and decisions were conducted exclusively by the Project Manager. Lately, Horizon Program Director assumed as the agent of the Navy, and the Project Manager became the agent for the Program Manager.

(1) Self Interest. The Navy culture and values ensured that the Project Manager would faithfully represent the interests of the Navy, which he knew better than any other authority in the Navy. From the point of view of the Agency Theory, the conflict was between advocacy and balanced risk assessment. Being a highly qualified

technical officer, the Program Manager might have looked for higher performance over a reasonable risk. In fact, in the interview included in Appendix C, he said that he had no doubt about the capacity of ALPHA to succeed, and never thought about an scenario of performance failure without a solution based on some more time. Consequently, he considered that risk was mostly in the schedule and financial domains. Cost risks were supposed to be related to interest rates changes only. Once a full time Program Director was appointed, advocacy got some balance with risk. Program Director rewards were related to the risk of failure to obtain a working system in a reasonable period of time. His concern to avoid high risks for his career was coincident with the Navy's interest to establish a reasonable awareness and control of risks.

(2) Adverse Selection. The small size of the Chilean Navy, with less than 1,500 officers, makes adverse selection unlikely, specially for this kind of high profile projects. For the same reason, the signalling phenomena, or trying to make an impression rather than actual performance, was not expected.

(3) Moral Hazard. The Project Manager's main incentive was professional satisfaction, which made moral hazard not a problem. The Program Director had, as mentioned before, more concerns about his career risk, but a poor performance would deprive him from the high visibility potential of the project. This different point of view was beneficial for the Navy.

(4) Incentive Schemes. During all periods of the project, the rewards for the Project Manager were based on professional satisfaction and the high visibility of the project. He was not senior enough to have concerns about his survival in the Navy. For the Program Director, the incentive was also professional satisfaction, but the influence of the short terms results of the project on his career had also an impact that he could not ignore.

(5) Summary of Agency Theory. Agents were chosen and chartered in an appropriate way to represent faithfully the interests of the Navy. During the initial and more important period of the project, the Project Manager could have harmed the interests of the Navy assuming a too optimistic and/or performance over risk oriented

position. The role of the Program Director provided a counterbalance, but it came later than it should have.

c. Information Processing Model

Since projects deal with a great degree of uncertainty, the information processing model should give some insight about how the organization deals with uncertainty.

The information gap to be handled by the organization lies mostly in the legal and business expertise, and the knowledge about the real commitment and capabilities of ALPHA. The uncertainty reducing strategies suggested by the model were present in the organization as follows:

(1) Slack Resources. One way to deal with uncertainty is to have more resources than initially expected to use. In this case, potential resources were time, money, information and expert personnel. The only slack resource given to the project was time. Budget was established for a long period, and specialized personnel would not be available. Information was obtained by the Project Team with no support from other organisms of the Navy. Another effect of the lack of extra resources was the difficulty to detect and take advantage of opportunities for improvement. Those opportunities are frequent in developing projects.

(2) Self Contained Units. Having all information processing needs concentrated in multi-task units helps to process information faster and easier. Project Management organization is the kind of self contained unit envisioned by Galbraith when he presented this model. Project Kilo was a small and self-contained organization.

(3) Vertical Information Processing. Uncertainty can be reduced by improving the means to acquire information, produce meaningful data, and distribute it to the decision makers. These capabilities were not strongly present in the organization. The Program Director and Project Manager had to deal with what information they could get from the fleet and the providers on request, and the computational means to process that information were limited to a basic network of personal computers.

(4) New Lateral Relations. At the beginning of the Project, the small organization had no means to establish fluid relations with other parallel organisms. The task was overwhelming, and the two officers had to spend most of the time analyzing and handling their project.

When the Directorate for Program Horizon was created, its officers were drawn from the fleet and from the technical directorates, Weapons and Engineering. They were supposed to make full use of the background and technical skills of those directorates. However, transferring knowledge and experience is not an easy task. An officer from the Directorate of Naval Engineering described this background, experience and collective expertise as a "cloud of knowledge,"[23] that can not be transferred through documents or individuals.

This new organization blocked the desired horizontal relationships. Program Horizon was given better material and human resources than its sister directorates. Horizon people viewed themselves as better organized, while the other directorates viewed Program Horizon as a threat to their traditional areas of influence. As a result, horizontal relationships that could have helped to reduce the degree of uncertainty were severed.

Within Program Horizon, the situation was completely different. The lean and horizontal organization promoted lateral communications. The appointment of a coordinator helped to ensure the horizontal relationships.

*(5) **Summary of Information Processing Model.** The* strategies suggested by the Information Processing Model to cope with uncertainty at the organizational level were not exploited, with the sole exception of the self-contained unit strategy, as applied to Program Horizon and Project Kilo organization.

d. Interpretivist Model

According to this model, the organization is classified according to the uncertainty of the task, meaning the degree of knowledge on how to perform it, and the

---

[23] This expression was coined by Commander Carlos Fanta, and was used by him in relation to this particular issue in discussions where the author was present.

uncertainty of the goals, or what is to be accomplished through the organization.

The procurement of the Kilo missile system had a clear set of goals, but there was not complete knowledge about how to perform the tasks of the procurement. For this kind of situation the model establishes the need for a control system that promotes the debate about how to perform the task, and provide data for comparison between multiple alternatives.

The control system in place, directed by the Project Handbook, considered a review by the authority chain on the passage from one stage of the project to the other. For example, when going from preliminary project to definitive project, a preferred option was selected. That decision had to be approved by the Program Director, the General Director for Logistics, and the Commander in Chief. Typically, the Project Manager explains and advocates the decision he could get working alone, in a part-time situation. Occasionally the Program Director arranges a meeting with a panel of experts and users to discuss the project, but this is not required. Consequently, the control system promotes data acquisition to support the decision process, but does not provide opportunities for debate, although the Program Director can encourage that debate despite the control system.

According to the first Project Manager, he had to work for the most part within his team of two officers, himself and the weapons expert, with little input from other parties. The Program Director had no opportunity to devote the attention and time he had desired, so most decisions were made independently by the Project Manager.

e. Summary of Organization and Manning. The Chilean Navy was not appropriately organized nor manned for the task. The Program Director and Project Manager were forced to deal with complex specialized tasks for which they had not enough experience nor expertise. However, the Navy was able to learn and evolve in the right direction, improving the organization. The following are the critical areas of the organization:

(1) Legal Support. According to the Project manager, the part-time legal support from the lawyer who worked in contracts for the Navy was adequate, but ALPHA lawyers had a much better understanding of their production process, cost structure and business practices. Those lawyers were skillful negotiators, having a significant

advantage over the Project Team.

(2) Testing and Evaluation. Tests were conducted by the contractor and witnessed by the Plant Representative. The Chilean Navy had four months to review the description of the components and the test protocols. Instead of having a technical staff to revise and evaluate those protocols, the Project Manager and Plant Representative had to do it by themselves.

(3) Part Time vs. Full Time Dedication. At the beginning of the project, when the contract negotiation took place, the Project Manager was dedicated part time to the project. Their experience conveyed the need to establish a full time Project Manager within a Program Office dedicated completely to handling related projects.

(4) Commitment and Competence. The factor that allowed the Navy to achieve a relative success was the commitment and competence of the Project Team members. They learned to use their talent and ingenuity to overcome their lack of experience and expertise. Another factor of success was the flexibility of the Navy to improve its organization as it learned from the accumulated experience.

(5) Specialized Staff. The project had not enough officers with specific responsibilities in Test & Evaluation, Logistics, Configuration Management, and Cost Management. It did not have a legal advisor exclusively for the program, nor an experienced international business manager. As a result of this lack of specialized staff, the level of risk of the project was significantly higher than what it could have been.

2. Measure of Success of the Project

This section addresses different approaches to measure the relative success of the procurement. It also outlines the relationship between these variables and the value of the weapon system for the Navy.

(a) Assumptions for Measuring Success. Other than the contract, there was no other document where the specific goals of the project were established and given relative weight. Acceptable limits for deviations and evaluation for departures from those limits were not established either. According to the contract, the information given by the original and current Project Managers, and other officers in Program Horizon, an approach

to what should have been considered procurement relative success is defined in Table 4.1.

Any parameter beyond the worst acceptable value is considered a failure. Results between the best and worst scenario are considered a relative success. The expected scenario reflects what the Project Manager assessed as the probable outcome when the contract was signed.

Scenario: Parameter	**Best Possible Case**	**Expected Scenario**	**Worst Acceptable Case**
Buyer's Gain	52.6%	41.0%	0.0%
Performance	As specified	As specified	As specified
Libor Rate	4.5%	5.5%	6.5%
Cost	88 Million	81 Million	76 Million
Schedule Delay	0 Years	2 Years	4 Years
Logistic Support	Excellent	Adequate	Minimum to keep system working
Political	Strong Commitment Improved relations New Projects Started	Stable Commitment No Interference	Low Commitment Minor Interference Worse relationship

Table 4.1 Measure of Success for Project Kilo

Performance is considered an on-off outcome. However, features that can extend the tactical useful life have a positive impact in buyer's gain. Cost is evaluated in terms of the predicted prices considering interest rates and late fees. Schedule expected scenario of two years is consistent with that expressed by the Project Manager. Doubling that delay is considered the worst acceptable scenario.

Logistic support is evaluated in terms of the opinion of the Project Manager, due to the lack of objective measures in the contract or other document. There were not figures in place to evaluate objectively the impact of logistic support in the life cycle cost and effectiveness of the weapon system. Political interference is the effect of the actions of political leadership, both in Chile and in Omega, over the outcome of the project. Political

interference is also evaluated according to the opinion of the Project Manager, as indicated in the table.

(b) Models to Assess Relative Success. In Appendix B, two models are introduced to evaluate the outcomes of the procurement.

(1) Tactical Value and Risk Model. This model defines the outcome for different scenarios in terms of buyer's gain. That gain represents the value that the Navy obtains over the worst expected scenario. The value is given by the life cycle cost of the weapon system, its tactical value across its useful life, and the probability of being required by a conflict. The model captures the effect of delays, variations in price, cost of ownership, obsolescence, interest rates, and risk of conflict. This model does not evaluate logistic support and political interference.

This model views a weapon system as an investment that will cost some money to the buyer (the government) through its life cycle, which is usually referred to as Life Cycle Cost, and will give some value in return year after year, as the weapon system performs the task. The value depends mainly on two aspects:

- The capability of the weapon system, or its capacity to perform its missions.
- The risk of conflict, which makes the weapon system necessary.

Evaluating the tactical value of a weapon system or the risk of conflict in monetary terms is extremely complex. To overcome this difficulty, the model assumes that the expected scenarios reflect the range of relative success of the weapon system procurement. There has been no risk of conflict between the date of the contract to the present. The effect of this lower-than-expected risk, which is out of the control of the Project Manager, reduces the value of the system when evaluated against the baseline, since the actual need for the system was less than expected.

According to the model, the final result of the procurement was a buyer's gain of 17.4%, about one third of the expected gain. However, if the contract had been fulfilled as specified, the lower-than-expected risk had caused a 20% buyer's loss, meaning that the Navy had fielded the Kilo system four years early, when there was no risk of conflict. Consequently, the resulting figure can be considered as a relatively high degree

of procurement success. Figure 4.4 shows a summary of the expected scenarios and actual results.

Parameters common for all scenarios:	
Time to Logistic Obsolescence:	25 years after fielding
Time to Tactical Obsolescence:	15 years
Initial Cost Of ownership:	US$ 880,500 per year
Final Cost of Ownership:	US$ 1761,000 per year
Discount Rate:	Libor + 1%
Confidence level (No Conflict)	95%

	Libor rate	Delivery Delay	Present value of payments	Buyer's Gain	Remarks
Worst Acceptable Scenario	6.50%	4 years	US$ 75,435K	0.00%	
Most Probable Expected Sc.	4.50%	2 years	US$ 83,751K	41.03%	
Best Expected Scenario	4.50%	0 years	US$ 88,073K	52.62%	
Result of the Procurement	4.00%	4 years	US$ 79,265K	17.42%	Reduced Risk and Increased Tto
If Contract had Been Fulfilled	4.00%	0 years	US$ 88,073K	-19.98%	Reduced Risk

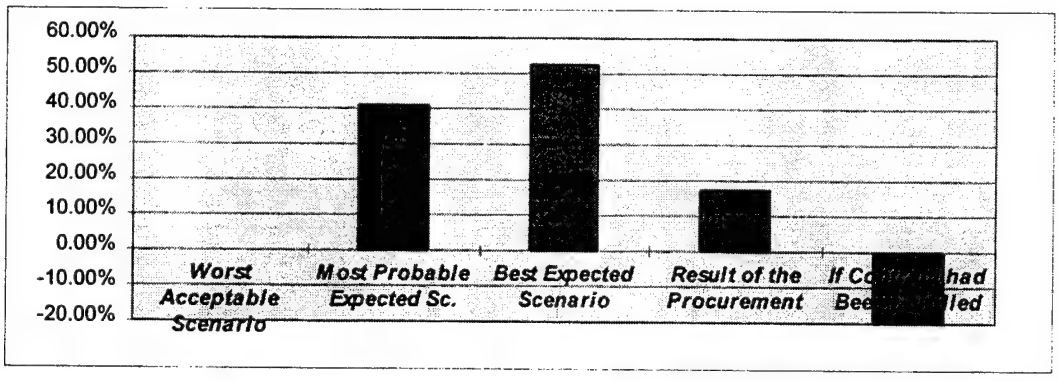


Figure 4.5 Summary of expected Scenarios and Results

(2) Risk and Damage Reduction Model. An alternative way of determining the value of a weapon system is to relate it to the defense strategy of the country, in terms of the contribution of the weapon system to reducing the risk of a conflict and its subsequent costs. Under a strategy of deterrence, weapon systems are purchased to minimize the risks involved in military conflicts. Those risks are related to the uncertainty about the probability of conflict, the consequences a conflict, the effect of the system to be procured in terms of reducing that risk of conflict, and the effect of the system in reducing the damage

caused in a conflict. The model (as shown in Appendix B) was not actually used in this thesis to calculate a specific value, but rather to illustrate the decision making process involved in procurement. Obtaining actual values from this model requires information and analysis well beyond the scope of this thesis.

3. Uncertainty and Risk Handling

As mentioned in Chapter II, in the context of procurement, risk is the result of uncertainty about the outcome and the impact of worse than expected results (notice that the "expected" is a quite dynamic idea). The analysis of risk focuses on the following three major areas as discussed in Chapter II:

- Procurement risk, including:
  - Cost
  - Schedule
  - Performance
- After sales support risk
- Political risk

a. Procurement Risk

The first and main part of the risk analysis is going to concentrate on Procurement Risk, including the risk of having to assign more resources than expected, having the system fielded later than expected, and getting a system that cannot do what it was expected to do.

(1) Cost Risk. The contract for the procurement of the "Kilo Missile System" was a Firm Fixed Price type, with adjustment for external variables and an associated Financial Agreement at a floating interest rate. Part of the uncertainty of cost for the Chilean Navy was due to the adjustment variables used and fluctuating interest rates.

(a) Expected Outcome. The expected results in terms of cost were reflected in the payment schedule of the financial agreement as predicted for a two year delay: US$ 81 million dollars[24] were to be distributed along ten years, with minor

[24] This value includes only the price to be paid to ALPHA, expressed as present value at a discount rate of Libor + 1%. Other costs incurred in transportation, administration and

adjustments according to interest rate and wage index. LIBOR rate was expected to be close to 4.5%, given a loan interest rate of 6%.

(b) Relationship with Schedule Risk. There were two mechanisms that tied cost risk with schedule risk:

- Late deliveries implied later charges associated to those deliveries, hence lower debt and less interest payments.
- Late deliveries also had associated late fees, actually reducing the cost.

Figure 4.5 shows the potential effect of changes in interest rates and late deliveries over the total amount paid. For example, a delay of two years (eight quarters) will decrease total payments by 4.9% or $4,321,000 ($88,073,000 - $83,752,000) if LIBOR rate is 4.5%.

Net Present Value of Total Payments

Discount Rate = Libor + 1%

DELAY QUARTERS	LIBOR RATE, %		
	4.5	5.5	6.5
0	$88,073	$85,474	$82,978
4	$85,128	$82,452	$79,897
8	$83,752	$80,949	$78,286
12	$82,461	$79,550	$76,801
16	$81,249	$78,250	$75,435
	US$ x 1,000		

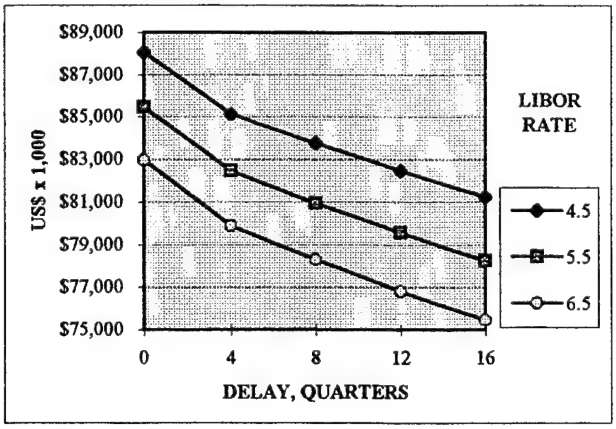


Figure 4.5 Effect of Libor Rate and Late Deliveries Over the Net Present Value of Total Payments

(c) Factors That Can Increase the Price of a Fixed Price Contract. Other cost risk related to fixed Price contracts are analyzed according to the framework established in Chapter II. In that chapter a series of possible causes for cost

---

installation are not covered by this thesis.

overruns in fixed price type contracts were presented. In this analysis each of them is considered and assigned a level of risk according to the specific situation of the Project Kilo.

- *The buyer is forced to pay for extra performance because the seller can only provide a superior system, while the current system, with the required performance, is out of production.*

Article 14.1 of the contract specified that any improvement adopted by Omega Navy should be offered to the Chilean Navy, which could acquire the parts and services required for the improvement modification at terms and conditions to be agreed upon. It did not allow ALPHA to force the adoption of such improvements. The possibility was open but restricted to the available funds.

- *The buyer may be tempted to pay for an extra performance offered by the seller.*

Similar situation: the Program Manager might be tempted by the offer, but if he gets no funds for it, there is no such risk.

- *The buyer is forced to pay for an extra feature, device, service or special tool not included in the contract but that turns to be indispensable for the safe and/or effective operation of the system.*

Article 14.3 of the contract makes ALPHA responsible to provide, at no cost, all elements necessary for safe operation. The specifications for compliance were written in terms of effectiveness. Consequently, the risk associated was related to the quality of performance specifications. In this case, it means low risk, given by those specification not included in the contract.

- *The buyer is forced to pay for a good or service that seemed to be included in the contract, but was excluded by some tricky clause. The following are examples of those clauses: Force Majeure, Insurance, Taxes, Transportation, Storage or Supervision Expenses.*

The risk was high, given by the amplitude provided by Article 8: "Force Majeure". It is also increased by the lack of control and insurance of the hardware from the reception in the factory until its loading in a ship.

- *The buyer is forced to renegotiate the price under pressure by the seller. "Pay more or I go out of business" or, "this costs much more than expected" argument.*

A company owned by the government and committed in the same project for its own government will not go out of business for a difference in cost. Exogenous variables might have increased the cost through Article 3.2 (Price Adjustments). The risk for those variables was explicitly accepted by the Chilean Navy. As compared with the total cost and the chances of dramatic changes in the variables considered, the risk was moderate. At the same time, having price adjustments avoids the excuse of these factors to reopen price negotiations, where the contractor has nothing to lose.

- *The buyer is forced to spend extra money in travel, supervision or other expenses because of unexpected conditions.*

The cost of travel and supervision was insignificant when compared to the cost of the Project. There is no significant risk associated.

- *The seller refuses to pay late fees or other dues.*

The contract did not include a clear mechanism to make effective the late fees. The probability of having to charge late fees was high, as delays were expected. However, late fees can only reduce the procurement cost, thus improving the outcome from the point of view of cost risk. From the point of view of schedule risk, which is analyzed in the following section, the lack of this mechanism increased the risk. The structure of the contract created a trade of delay for cost.

- *The buyer is forced to spend money in legal battles with the seller or is forced to settle at a disadvantage.*

This risk pertains to the "unknown unknowns" area. Everything was provided to settle disputes before reaching legal battles. The chance of success in such case is so poor that the probability of expenditures for that reason should be low. But the difference in business references, language and ethical standards made the "unknowns" a real issue, affecting not only cost but also performance and schedule. Consequently, the possibility of legal battles can not be discarded.

- *Cost increases due to changes.*

Changes were not allowed in the contract unless a written amendment was signed. In that situation, if the Project Manager had no extra funds assigned,

he would not order changes that could increase the cost. Besides, since the system was specified in terms of performance, changes were not likely to be asked if the required performance was clearly stated.

(d) Summary of Cost Risk: Cost risk was low, given the nature of the agreement (Fixed Price), the provisions of the contract and the commitment of ALPHA with its owner, the government.

(2) Schedule Risk: Schedule risk is the combined effect of the probability of not having the system within the expected time, and the consequence of that delay.

- ***Probability vs. Consequence:*** When assessing this risk, it is very important to differentiate between the probability and impact of an adverse outcome.[25] The probability of having a considerable slip on schedule was high, and the Project Manager was aware of that. A delay of two years was expected, and the impact of a delay up to three or four years was not considered important, given the strategic situation of the country. (See Chapter II, Strategic Environment)

- ***Expected and Contracted Delivery:*** The Program Manager was conscious that the delivery would take up to two years longer than the agreed delivery schedule, so "expected delivery" means two years beyond the contract delivery schedule.

- ***Incentives:*** The major consideration to set some reasonable incentive to limit the delay to acceptable terms was established in Article 9.1 (Termination for Delay), and Article 7 (Compensation for Delays). These incentives, however, had the weakness of being hard to enforce and not significant in dollar value. (In the worst case of delay, the total late fees would be less than two million dollars, 2% of the price). The Chilean Navy could not afford to terminate a contract unless the prospects for success were definitively low and a significant amount of money was attached to the delayed subsystems/units. However, under such circumstances, the Chilean Navy could use the Letter of Credit to recover the money, putting ALPHA in a very uncomfortable position. The following step would be selecting a different manufacturer to provide the terminated item, probably at a much higher price.

---

[25] Equation 2.1 in Chapter II describes risk as the combined probability of an adverse result and the impact of that result.

- ***Concurrence:*** There was a high overlap between development and production, which was difficult to assess. The degree of advancement was not known before signing the contract. This situation increased schedule risk, but there were no means to avoid it given the lack of access of the Chilean Navy to ALPHA activities. Signing a first contract for development without a commitment for production had increased the cost risk to unmanageable levels, and multiple sourcing was not the solution to produce only three systems.

- ***Summary of Schedule Risk:*** Although delays were expected and uncertain, schedule risk was low given the minor impact of a potential delay. That impact was balanced with the trade-off between cost and schedule resulting from the late fees mechanism and the reduction of debt for later charges associated to deliveries.

(3) Performance Risk: As mentioned in the case, ALPHA had its system in a development stage, having proven successfully a prototype.

(a) Expected Results: The Project Manager expected that ALPHA was going to deliver the system with the alleged performance. During the exploration and negotiation process, the Project Manager approached Omega Navy to obtain accurate information about the degree of development of the system. His efforts were not successful; Omega Navy authorities demonstrated absolute loyalty to ALPHA, and denied any cooperation in that stage.

Despite the lack of complete information, the Project Manager was confident in the capacity of ALPHA to deliver the system with adequate performance, although in more time than promised. In the interview conducted in October 1995, the Admiral who was then the Project Manager[26] said that he never thought about a scenario of performance failure. If anything went wrong, he believed it could be solved with time.

(b) Consequences of failure: This assumption made it reasonable that the eventual consequences of such a failure were not fully assessed. However, in the same interview, he said that if he had the chance to do it again, he would be less naive and more pessimistic in the design of scenarios for negotiation and contingency

---

[26] Interviews are included in Appendix C

planning. He also mentioned that he would have described the final product more precisely.

(c) ***Preparation for Failure:*** Time has shown that the predictions of the Project Manager were accurate. The system performed satisfactorily, but it was delivered long after the promised date. However, a more thorough risk analysis, stronger incentives and contingency plans for the eventual failure of ALPHA should have been considered. If a failure had occurred, the consequences would have been devastating, mainly because Project Kilo was not prepared for such event.

(d) ***Summary of Performance Risk:*** It can be concluded that performance risk was higher than initially assessed, concentrated more on the consequences of a failure than on the uncertainty associated with it.

(4) ***Summary of Procurement Risk***: Considering the different components of risk, Project Kilo had an overall medium risk, with the worst potential outcome being the inability of ALPHA to deliver a major component of the system as specified. Such a circumstance could have caused the termination of the contract and the need to look for an alternate supplier and start the project again. The inclusion of a new contractor would have significantly increased the cost and schedule. Even worse, a failure could have resulted in the cancellation of the Project. Table 4.2 summarizes the procurement risk for Project Kilo in terms of the uncertainty of success and the consequences of failure.

b. Logistic Support Risk

The risk of losing capabilities after the system is fielded because of lack of support is related to the characteristics of the system, the scope of the procurement, the customer base and the relationship with the contractor.

This being a new and unique system, the dependence of the customer on the contractor is necessarily high. There are means to reduce this dependence through the inclusion of maintenance equipment, spare parts and knowledge with the system. When the procurement does not includes a significant number of units, such as in Project Kilo, transferring all the maintenance capability is too expensive, so an intermediate solution has to be found.

Risk Component	Uncertainty	Consequence	Component Risk
Cost	Low	Medium	Low
Schedule	High	Low	Low
Performance	Low	High	High
Overall Procurement Risk			**Medium**

Table 4.2 Procurement Risk

Involving the users and maintainers early in the definition of the system and in the negotiation process would have helped to reduce logistic support risk. However, for reasons of secrecy, users were called only occasionally to provide inputs. The Project Manager had long experience as a user and maintainer himself, but it is hard to assess to what extent his compromised position made possible a fair advocacy for logistic support considerations.

(1) Logistic Support Means Included in the Contract: The contract for Project Kilo established the following means related to logistic support:

- Maintenance training for ship crews at ALPHA facilities
- Installation of the system in Chilean Navy shipyards with supervision of ALPHA
- Inclusion of test equipment and maintenance documentation into the deliverables of the contract
- Obligation of ALPHA to provide spares parts for ten years at a reasonable price

(2) Measures to Reduce Logistic Support Risk: Several contractual provisions are suggested in Chapter II to decrease logistic support risk. Here those measures are contrasted with the support means included in Project Kilo.

- *Provide any spare parts needed for "x" years at reasonable prices.*

Article 12.1 of the contract included the obligation to provide spare parts at a reasonable cost for ten years after completion of the Factory Acceptance Test of the last system.

- *Provide the test equipment, special tools, software and all elements needed for maintenance and logistic support.*

All these elements were included in the description of the system, Article 2, of the contract. These included the test equipment necessary for depot maintenance.

- *Provide the training, supervision and technical support for in-house maintenance.*

Training and supervision were included in the contract. Technical support for further in-house maintenance was not mentioned.

- *Provide the documentation and technical data needed for maintenance, diagnosis and spare parts identification.*

Documentation and technical data were included, but specifications regarding the format and content were not enough to ensure their usefulness.

- *Provide the technical data required for upgrades or integration with other new systems.*

Data for integration was provided by the Chilean Navy, and ALPHA also provided their interface data. Upgrades were not considered.

- *Use international standards for parts, integration links or modules.*

There was no requirement for standard parts, and the detailed design was not accessible to the Chilean Navy. There was, however, an agreement about the standard for software and communications, both widely used in defense systems and familiar to Chilean Navy technicians. Higher involvement of Technical Authorities would have helped to encourage the use of standards for easy access to parts and increased maintainability.

- *Use commercially available parts and materials to certain extent.*

There was no requirement about this matter.

- *Keep a network of technical assistance, part sales and authorized maintenance facilities within or close to the bases where the system is maintained, or in certain areas of operation.*

Maintenance and test equipment was purchased with the system, but no network was formally established to enhance or update those facilities in the future.

- *Ensure the availability of technical support, parts and services without restrictions by the seller (such as exclusive distribution channels) or its government (sanctions or embargoes). Otherwise, the capacity to perform in-house (or at least in the country) support must be acquired with the system.*

Given the particular characteristics of a missile system, it is highly unlikely that spare parts can be found in the general marketplace for all components. As such, the technical dependence on ALPHA was unavoidable. In house maintenance was considered in the equipment, training and installation of the systems.

Political interference on technical or logistic support was not considered a problem, since Omega had demonstrated its reliability in that matter.

- *Use a language understandable for all parties involved, typically Spanish or English.*

The contract and all the documentation was written in English.

(3) Influence of Chilean Navy in Design: The lack of influence of the Chilean Navy in the development process made not possible the adoption of other support risk reducing measures such as Form-Fit-Function or P^3I design, or higher participation in the design by the Chilean Navy.

However, there were exceptions to this situation. The Chilean Navy provided a significant amount of expertise in software design, having adequate control over the development and maintenance of software. The same was true for trajectory design, where ALPHA modified their specification when Chilean experts demonstrated that they could not meet the threat with the original design.

(4) Customer Base: It was considered that having the Omega Navy as a costumer, ALPHA would have spare parts available at reasonable price. The contract established such an obligation, but there was no quantified method to establish fair price and conditions. The only possible reference would be Omega Navy.

*(5) **Summary of Logistic Support Risk:*** The success of logistic risk management is hard to evaluate at this point. The system is just going through harbor and sea trials, so there is not enough experience to judge the effectiveness of the measures taken to reduce this risk. From the information available, it can be said that the uncertainty about logistic support risk is moderate, and the impact of an eventual failure is high. Consequently, logistic support risk was high.

c. Political Risk

When the project was initiated, the political risk was low because of the low uncertainty about political decisions and the relative autonomy of the Navy. However, as time passed, the political system evolved, civilians are now in power, and the chances of having the procurement budget questioned are increasing steadily. The extension of the delivery had the effect of exposing the project to controversy.

The main question was how long it was going to take for the new political authorities to get into the budget, and how high was procurement in their priorities. The long tradition of respect for international agreements provide a certain tranquility.[27]

On the part of the seller, there were also components of political risk. When the negotiations took place, Omega Navy had not formalized a contract with ALPHA for the procurement of the Kilo system. Chilean Navy negotiators were confident that this would happen, but Omega Navy refused to provide any information about the advance of the project nor about their commitment to it. Finally, Omega Navy signed the contract (after the Chilean Navy did the same), which lifted that component of risk.

So far, most payments have been made, the equipment has been delivered to Chile, and the remaining work is going to be performed by Chilean Navy Shipyards. There is no political uncertainty anymore.

The political risk was low because the high certainty about the commitment of resources through an international agreement, although a budget reduction could have had

---

[27] Chile was the only country in the southern cone that went through the oil crisis and the debt crisis without defaulting any of its international obligations.

serious consequences.

4. Contract Negotiation.

The importance of the negotiation process cannot be overemphasized. This section analyzes how this process was handled by the negotiation team, composed by the Project Manager, his assistant, and the lawyer of the General Logistics Directorate.

a. Tasks of the Negotiators

In Chapter II twelve tasks were identified for the negotiators. In this section each one of them is explored and evaluated.

- *Develop a deep understanding of each other, its capabilities, constraints, priorities, values, language, culture, procedures, methods and any other circumstance that can affect the relationship within the parties.*

The culture barrier and lack of international expertise made it impossible to achieve this point satisfactorily. Negotiations were usually complicated by misunderstandings and need for clarifications, which made meetings long and tense.

- *Communicate mutual expectations in a way that both parties understand and agree upon.*

Expectations were communicated between the parties in most relevant areas. In the case of late delivery, the position of ALPHA communicated implicitly to the Chilean Navy that a delay would occur. The acceptance of the conditions by the Project Team communicated that some delay would not be a big issue.

- *Make sure that the promises cover all the requirements of both parties, not only about the goods or services, but also about how, when and where will they be delivered, what will be the future obligations after the delivery, what related support is required, what is included in the contract and what is not, and what criteria will be used to clarify unexpected doubts.*

This point is more controversial. There were imprecise specifications, insufficient time and means to revise test protocols, lack of clear mechanisms for late fees collection and vague statements for logistic support. The lack of experience, an appropriate technical staff, and expert legal advice made it very difficult to come up with a thorough and workable contract. However, the accomplishments were much better than it could be expected considering the available means.

- *Negotiate conditions that satisfy both parties and that are feasible for both.*

The contract as a whole was fairly reasonable. The commitment of ALPHA to a schedule that it was not able to fulfill was the only really problematic issue.

- *Explore all possible cases of non-fulfillment and design incentives or remedies to avoid such circumstances.*

This task was poorly handled. As mentioned in the interview with the Project Manager, the scenarios were generally optimistic. There were no provisions for a failure in performance or an unmanageable cost overrun, putting all the trust in the contractor. In terms of delays, the possibility was acknowledged, but provisions for flexibility were not included. The financial dependence on the contractor made it impossible to include stronger enforcement measures or incentives.

- *Explore all possible cases of misunderstanding or misinterpretation, and design mechanisms to avoid or overcome such events.*

Considering the circumstances, misunderstanding risk was handled successfully. The multiple communication channels, openness for renegotiation and arbitration clauses provided effective means to deal with any misunderstanding. The situation could have been different if Project Managers had been more inflexible in dealing with ALPHA's continuous changes in schedule, or if Navy authorities had not accepted further negotiations. The Navy could not afford a complete failure in this project, and ALPHA knew it.

- *Determine how the incentives or remedies will be enforced if necessary. Determine also other avenues that could be used by each party to ensure contract compliance.*

As mentioned before, enforcement was one of the weaknesses of the contract due to the particular circumstances at the time. However, the partial termination clause, the letter of credit in case of breach, and the pressure of keeping the image of ALPHA as a reliable supplier played in favor of the Chilean Navy. As mentioned by professor Mark Stone[28] in his interview, fluid relationships are the best mechanism to make a contract work.

---

[28] The interviews are included in Appendix C

- *Determine the consequences of a termination for both parties in all significant phases of the contract, and ensure that it will always be more beneficial to solve the problems rather than terminate the contract.*

Clearly both parties discarded a priori any chance of termination because of the importance of the commitments involved. For any of the parties, termination would have been catastrophic, although clearly more for the Chilean Navy than for ALPHA. The Chilean Navy had a letter of credit for the full amount of the contract, but it was in a bank in country Omega.

- *Relate the current contract with other current or potential commitments; determine how important is the contract for both parties relative to those other commitments.*

There were no other projects with potential value to move ALPHA to put an extra effort for the success of Project Kilo. The Chilean Navy could have used a project for the sole purpose of raising expectations, but there was an issue of future credibility behind that possibility.

- *Design mechanisms to introduce changes in the contract if agreed to by both parties.*

The contract was not as flexible as it should have been. Five amendments are a proof of this inflexibility. The willingness to renegotiate replaced, to some extent, contract flexibility, but renegotiations are not convenient for the buyer in a fixed price contract.

- *Specify the level of authority that the agents and principals had on both parties for the purpose of changes, renegotiation and problem solving.*

This was not a problem during the negotiation. Both sides were responsive about the agreements reached by the agents.

- *Determine the relative bargaining power of the parties throughout the negotiation process and during the performance of the contract.*

This is perhaps the most relevant part of a negotiation design. During the selection process, the bargaining power of the Chilean Navy was very strong due to the competition among six potential contractors. As the list was reduced to two (BLAST and ALPHA), the bargaining power was reduced. The lowest point was reached after the source selection, when ALPHA had been selected, and the contract was being negotiated along with

the financial agreement. The financial agreement was tied simultaneously to three other projects, which left a very low freedom of action.

After signing the contract, the situation was more manageable. The Chilean Navy was willing to renegotiate the schedule when excessive delays were apparent, and ALPHA was willing to accept responsibilities and offer something in exchange, either more services, features or quantities.

b. Summary of Negotiation Process

The negotiation process was conducted in the best way allowed by the existing circumstances and the means assigned by Navy authorities. To improve the result of the negotiation, the following measures should have been taken:

- Before the end of the source selection, a contract draft should have been provided by each of the candidates, and the terms and conditions of those drafts included in the final selection.

- A more complete negotiation team should have been assembled, including more technical expertise, business/legal expertise, financial management, and people proficient in the languages of all final candidates. Users, Technical Authorities and all other relevant actors should have been part of the team.

- Risk analysis based on worse case scenario, simulations and contract games should have been conducted to train the team and explore possibilities in order to reduce the "unknown unknowns", or provide strategies to cope with them.

- Financial dependence should have been reduced to a minimum, not beyond the upfront payment. Relating the cash flow to actual deliveries would have been a strong short term incentive.

- Delivery and payments should have been tied to complete working systems rather than to independent sets of hardware that had not been integrated.

- All performance test protocols should have been part of the contract and subjected to change if agreed to by both parties.

- The contract should have been more flexible, allowing for different levels of changes by different authorities.

- The possibility of a future project should have been explored more thoroughly, to create an extra contractual incentive for ALPHA.

5. Non-contractual Means Used.

The Navy and other services had a long term relationship with the Omega Government and with ALPHA. Without this relationship, no negotiation or contract would have been possible. Good relationships and communications between competent people is undoubtedly a strong mechanism to get things done. The careful selection of the program directors, project managers and plant representatives helped to keep these communication channels open despite the difficulties. The prestige of the contractor in the international weapons market was another strong incentive. An additional incentive can be the expectation of continuing business with the Chilean Government, a small but reliable customer. For reasons of secrecy and the lack of future projects of the magnitude of Kilo, neither of these two incentives were exploited as well they could have been.

E. MAJOR FACTORS AFFECTING THE RESULTS OF THE PROJECT

In this section, the results of the project, and the major factors affecting those results are summarized. The results are extracted from the information from the case as shown in Chapter III, and from the measures of success explained in Section D.

1. Results

The procurement of the Kilo Missile System was relatively successful. The Program Manager expected a delay of two years beyond the date specified by the contract to have the first system fielded. It took finally four years to reach to that point, but now the Navy has a leading edge missile system, obtained at a very low price. The trade-off effect between schedule and cost, and the lower than expected interest rate, resulted in a final cost 9% lower than expected, even lower than the cost specified in the optimistic scenario. The lower than expected risk made the extra delay beneficial for the Navy, as shown in the Tactical Value and Risk Model in Appendix B. The contractor has provided design improvements and extended services to the Chilean Navy, in compensation for the unexpected delays. Those improvements may extend the tactical obsolescence point for a period equivalent to the delivery delay.

The evaluation provided by the Tactical Value and Risk Model shows that the procurement resulted in a buyer's gain of 17%, lower than the expected 41%, mainly because of the reduction in risk of conflict since the date of the contract, and the reduction in total payments. In fact, if the original terms of the contract had been fulfilled the result would have been a buyer's loss of 20%.

In addition, the Chilean Navy was lucky in the sense that the identified risks have not materialized so far. Particularly critical was the possibility of even further delays, that could have had a political impact, eroding the commitment of the Navy or the government.

2. Major Factors of Success

The following factors were judged to be the most significant contributors to the relative success of project Kilo.

(a) Competence of the Main Actors. The complexity of the task required extremely competent and versatile people. The Navy has been wise to give high priority to professional education for a long time. That commitment allowed the Navy to have competent and well prepared officers to handle the project.[29]

(b) Risk Assessment and Prediction of Outcomes. The Project Manager predicted accurately the outcome of the project. Performance and cost, where risk were considered lowest, were not a problem. Schedule, where uncertainty was high although its impact was minor, was the only area where predictions were too optimistic. The Navy was prepared to take advantage of these delays, and it did to some extent with cost reductions.

Although the analysis of this thesis shows that performance risk was underestimated, the experience and perspicacity of the initial project manager was proven right. This does not mean that a more thorough risk prevention effort would not have been highly beneficial. Had Omega Navy not committed itself to buy the Kilo system, the probability of a breach of contract had increased dramatically.

(c) Absence of Political Risk. Project Kilo enjoyed a permanent commitment within the Navy, and had no political interference. The Navy was consistently

---

[29] The Program Director, Project Manager and Assistant Project Manager graduated as Engineers in Chile and had Master Degrees in foreign countries.

supporting the project, putting the best people on it, and assuring the budget for a long period. Without political risk, the Project Manager had more freedom of action to handle the project. The Omega political system did not interfere with the project, since its results were important to ALPHA, a state owned corporation, and to Omega Navy.

(d) ***Predominance of Win-Win Criteria in Negotiations***. Throughout the negotiation and renegotiation processes, solutions that were favorable for both parties were achieved. Direct confrontation and attempting to harm the other party as compensation for the difficulties caused by the delays could have destroyed the relationships between the parties.

F. LESSONS LEARNED AND IMPLICATIONS FOR FUTURE PROCUREMENT

1. Long Term Commitment to Education is Essential for Successful Project Management

Weapon System procurement is a difficult and risky undertaking, one that requires the best people and support to be successful. The Chilean Navy's long term commitment to high level professional education in technology areas was a factor in the success of this project. Focusing efforts in negotiation and communication skills will improve not only project management capabilities, but also the ability to interact in a more complex strategic and political environment.

2. Teams with Multiple Skills and Adequate Resources are Needed to Handle a Project

Procurement Negotiation Teams with operational, technical, logistic, cost estimation, business, financial, and legal skills should be assembled for each project. To interact effectively, all team members need to understand the processes, needs, priorities, challenges and constraints of the Navy. They also need time, space, money, access to information, cooperation from other Navy organizations, and authority in order to negotiate with better chances of success.

3. Long Term Commitment Make Big Projects Possible with Scarce Resources

Budget stability and trust in long term decisions are crucial to make possible efficient procurements. The capacity to commit resources to a long term project allowed the Navy to purchase the Kilo weapon system.

4. Participation of Relevant Actors Improves Decision Making and Communications

Representatives from the fleet, technical authorities and operational experts could have been invited to provide input to the decision making and control process through regular committee sessions. This activity would have improved lateral relationships, increased information availability and handling, and promoted a rich debate and comparison of choices.

5. Risk Analysis and Negotiation Training Improves Procurement Negotiation Process

Risk analysis using simulation, cost estimation, technological investigation and negotiation games shall be conducted to prepare the project teams for the negotiation process. The committee mentioned in the previous point should also participate in this activity. A core of people educated to conduct this training is necessary to keep procurement capacity in the future.

6. Communications and Cooperation are Powerful Means to Improve Results and Reduce Risk

Fluid communications, open relationships between the parties, and concern of the seller about its prestige and future business are very important non-contractual means to enhance the chances of success. Having more early involvement of Chilean Navy technicians in the development activities of the system would have helped to improve relationships, get a better and more timely assessment of the difficulties, provide a better input of the Navy's needs, and improved the capabilities for in-house maintenance.

7. Experienced and Skillful Teams Can Take Best Advantage of Competitive Procurement

Competition is the strongest incentive to obtain favorable proposals from potential suppliers. The difficult part is determining if the suppliers are able to deliver what they promise, and if their commitment will endure beyond the beauty of the initial proposals. This is where technical skills, cost estimation, business experience, risk analysis, legal expertise and, more than anything, experience, are needed to arrive at a sound source selection decision.

8. Depending Financially on the Contractor is a Weakness and Should be Avoided

Financial dependence is a weakness inherent to a country the size of Chile, and constitutes a complete area for management and risk analysis. This dependence should be reduced as much as possible, and isolated from the area of influence of the contractor. In Project Kilo, the financial agreement should have been used only to cover the upfront payment.

9. Measurable Requirements are Necessary to Ensure Compliance

System requirements should have been written in a testable and measurable fashion. Milestones and payments could have been tied to development accomplishments and delivery of integrated and tested systems rather than pieces of hardware. Performance test protocols should have been included in the contract.

10. High Involvement and R&M Requirements Reduces Logistic Support Risk

Logistic support risk could have been reduced with increased involvement, and with the inclusion of Reliability and Maintainability specifications, related to the equipment provided for test and maintenance, and the spares sold with the system. A long term verification of the accuracy of R&M performance and adequacy of the spares list could have been included, tied to some form of warranty or compliance clause.

11. Opportunities Found in Developing Projects can be Exploited with Extra Resources

Slack resources in the form of money and expert personnel should have been assigned to the project to give it more freedom of action to take advantage of the opportunities provided by a weapon development effort.

12. Defining and Preparing for Eventual Failures Reduces Their Consequences

Criteria for defining a failure situation and ways to exit the contract with the least possible harm should have been designed. Even the most promising ventures can be faced with failure, and defining early warnings and measures to reduce the consequences are necessary to prevent failure and reduce the associated risk.

13. Negotiators that Look for Win-Win Conditions Have Better Chances for Success

Negotiation for a contract and for the multiple events that appear after it can be an intense and frustrating effort. Negotiators must contain their frustration and look for favorable conditions for both sides. This win-win effort requires ingenuity, flexibility and communication skills.

14. Non Contractual Means are Powerful and Necessary Complements in Negotiations

It is impossible to include all aspects of a procurement in a contract. The bargaining power of the parties to handle contingencies depends heavily on non contractual issues, such as the quality of the relationships, the concern of the contractor about its prestige and the prospects of further business.

G. SUMMARY OF CHAPTER IV

This chapter contains the analysis of Project Kilo Procurement, as outlined in its first section. It identifies the challenges faced by the Project team and the way those challenges were met, using the theoretical tools explained in Chapter II. In the next chapter, the information obtained from the analysis will lead to the conclusions of this thesis.

V. CONCLUSIONS

A. INTRODUCTION

This chapter presents the conclusions derived from the different sections of the analysis. These conclusions are the synthesis of the complete experience of the procurement of the Kilo Missile System. They help to define the results of the project, explain why things happened, and what could have happened.

The conclusions form the basis for the answers to the Research Questions included in Appendix D. They will also be reflected in the recommendations suggested in Chapter VI.

B. GENERAL CONCLUSION

The procurement of the Kilo Missile system through a contract with ALPHA Industries presented complex challenges for the Chilean Navy. Without enough experience and expertise, and with an inadequate organization facing high risk, the Project team was able to achieve a successful procurement.

The success of the project was due to the competence of the successive Project Managers and their teams, the consistent support from Navy authorities, the capacity to commit resources in the long term and the good relationship between ALPHA and Project Kilo.

C. SPECIFIC CONCLUSIONS

The following specific conclusions provide the details for the general conclusion stated in the previous point. They are derived from the analysis of the case:

1. Major Challenges for the Project Kilo Team

The major challenges faced by Project Kilo team members were:

a. Acquiring an effective missile system without a technology base and limited resources, which forced the Navy to take the choice of a high risk immature system.

b. Making decisions and negotiating with expert businessmen with different business references, language and ethical standards. Project team members had to perform these tasks without adequate guidance, support, experience

and expertise for successful completion, while being exposed to the high impact of a possible failure.

c. The lack of resources, allowing ALPHA to take an advantaged position as contractor and lender.

d. The incorporation of a new kind of technology with a structure that impedes technology transfer.

2. Favorable Factors for the Project Team

Some challenges that are usually present in procurements were not so for Project Kilo. Because of its magnitude and importance, the project enjoyed strong and consistent political support from the Navy, while avoiding high level interference. Because of this support, the Navy kept Project managers in the organization for a longer period of time than normal.

3. Lack of External Expert Advice

The secrecy of the project deprived the Navy from getting external expertise in the legal and international business areas.

4. Organizational Limitations and Improvements

The creation of Program Horizon improved the organization by providing full time dedication and better coordination. However, it failed to bring aboard the cooperation, experience and expertise of the Technical Directorates.

5. Negotiation Position of the Parties

By selling the Kilo system to the Chilean Navy, ALPHA and the Omega Navy would benefit from an external source of financing and a free test bed for its new weapon system. ALPHA knew that the Chilean Navy would suffer serious consequences from the termination of the contract. The leverage for the Chilean Navy was ALPHA's prospect of a long term relationship with a loyal customer, and other potential customers.

6. Cost and Schedule Risk

Cost and schedule risks associated with the contract were low, given the structure of the contract and the strategic situation. The provisions of the contract created a tradeoff mechanism between schedule and cost: The longer the delay, the lower the cost. Cost

savings were a high priority and made the schedule delays acceptable.

7. Performance Risk

Performance risk was high because Kilo was developmental system and the project lacked contingency plans for hardware failure.

8. Logistic Support Risk.

Logistic support risk was high. A strong Logistic Support system needed to be established since the Chilean Navy in-house capability for this system was inadequate. Involving the users, maintainers and technical authorities early in the definition of the system and in the negotiation process would have helped to reduce Logistic support risk.

9. Political Risk.

Political risk was low because the resources had been committed through an international agreement. On the seller's side, Omega had a good record of restraining political interference from its companies' businesses. If the Omega Navy had not committed itself to buy the Kilo system, the risk would have increased dramatically.

10. Measures to Improve Contract Negotiation.

Contract negotiation could have been improved by:

- Including contractual terms and conditions in the source selection.
- Having a comprehensive and expert negotiation team.
- Including all relevant actors in decision making.
- Assessing risks, defining worse case scenarios, and establishing contingency plans for failure.
- Ensuring participation of the Omega Navy before committing to a contract.
- Reducing the financial dependence to only to the upfront payment rather than the whole procurement.
- Relating outlays to concrete development achievements and deliveries of integrated working subsystems.
- Including performance test protocols in the contract and allowing for minor changes if agreed to by the parties.

- Exploring the possibility of a future project with ALPHA as an incentive.

11. Project Results.

The project was successful in providing a leading edge weapon system at low cost. The only poor result was the delay in system delivery, which had no negative consequences. Further delays, however, could have had a negative political impact.

12. Factors of Success.

A competent and committed Project team, a good prediction of the outcome, the lack of political risk, and good relationships were all essential elements to the success of the project.

VI. RECOMMENDATIONS

A. OVERVIEW

This chapter contains the recommendations for future procurements, which are derived from the conclusions of Chapter V and the lessons learned presented in Chapter IV. They project the conclusions and lessons learned from the Kilo project to future weapon acquisition, policy making and Project Manager training.

These recommendations are oriented primarily to the Chilean Navy, but they are also useful for the Chilean defense industry, defense contractors and other weapon system buyers, including the U.S. Armed Forces.

B. SPECIFIC RECOMMENDATIONS

The following recommendations, if implemented, should improve the results of future procurement processes:

1. Keep the Navy's Long Term Commitment to Education, and Extend it to Negotiation and Communication Skills

The Navy's long term commitment to high level professional education in technology areas was a factor in the success of Project Kilo. In addition to the new and renovated efforts toward technology, education should be extended to negotiation and communication skills. Such efforts will improve not only project management capabilities, but also the ability to interact in a more complex strategic and political environment.

2. Maintain the Capability to Put Together Teams with Multiple Skills

Procurement Negotiation Teams with operational, technical, logistic, cost estimation, business, financial and legal skills are needed to handle a project. Some of those skills, like international business expertise, might not be available in the Navy. In such a case, expert advice should be obtained as a consulting service after the necessary security clearance process.

Risk analysis using simulation, cost estimation, technological investigation and negotiation games are needed to train project teams for negotiation. To assemble and train those teams, the Navy needs to maintain a portfolio of officers with comprehensive education

in negotiation and contracting issues. Those skills should be included in the professional profile of officers that are going to be Project Managers.

3. Ensure Long Term Budgetary Commitment to Make Big Projects Possible

Budget stability and trust in long term decisions are crucial to make procurements possible and efficient. Few firms will be willing to deal with a government that cannot commit the necessary resources to finish a project. If a firm does so, it will charge a big premium for the associated risk. Navy authorities have to make their case if the political system restricts their ability to commit resources for long term projects.

4. Involve all Relevant Actors in Decision Making

The final user of the system, technical authorities and operational experts, should all provide their points of view in the decision making and control process through regular committee sessions. This involvement will improve information handling and reduce risks.

5. Recognize the Power of Non-Contracting Means in Negotiations

Although a contract is the cornerstone of the buyer-seller relationship, non contractual means are also important. Fluid communications, open relationships between the parties and concern of the seller about future business can be important means to enhance the commitment of the contractor. Continuing involvement and cooperation with the contractor are also ways to enhance the relationship with the contractor. It also helps to have timely and accurate information about the progress of the project.

6. Be Wise and Cautious in the Use of Competition

Competition is the strongest incentive to obtain favorable proposals from potential suppliers. The hard part of it is finding out if the offerors are willing and able to deliver what they promise. Technical skills, independent cost estimation, risk analysis, business experience, legal expertise and project experience are necessary to arrive at a sound source selection decision.

7. Reduce Financial Dependence from the Contractor

Weapon procurement made by small countries like Chile are usually financed with loans provided by the contractor or its government. These loans create a financial

dependence that weakens the position of the buyer, and requires careful management and risk analysis. This financial dependence should be reduced as much as possible, and isolated from the area of influence of the contractor.

8. Write Measurable Requirements that Ensure Performance and Supportability

System requirements have to been written in a testable and measurable fashion early in the negotiation, so that delivery can be established in a meaningful way. Performance test protocols should be included in contracts in accordance with the requirements.

9. Consider High Involvement of Navy Personnel in Contractor Activities and Comprehensive R&M Requirements to Reduce Logistic Support Risk

Logistic support risk can be reduced with increased involvement, and with the inclusion of Reliability and Maintainability specifications. Those specifications may be associated with the following, among others:

- Contractor's Technical Representative
- Logistic Support Contract
- Equipment provided for test and maintenance
- Training and documentation
- Spares sold with the system
- Adequacy of spares list
- Long term verification of R&M performance

10. Provide Flexibility and Resources to Take Advantage of Development Opportunities

Procurement projects have always some degree of uncertainty, which can be a factor of risk but also an opportunity for performance and logistic enhancement. Slack resources in the form of money and expert personnel should be assigned to the project manager. Those resources will give him more freedom of action to detect and take advantage of the development opportunities provided by the project.

11. Define Areas of Uncertainty and Prepare Contingency Plans for Possible Failures in Order to Reduce Risk

Every project has risk, and consequently the possibility of failure. Criteria for identifying and defining a failure situation and ways to terminate the contract with the least possible harm must be designed. It is necessary to define early warnings and measures to reduce the consequences of failure. Those warnings and alleviating measures will help to reduce the risk of failure.

12. Negotiate to Obtain Win-Win Conditions in Order to Have Better Chances for Long Term Success

Negotiators must overcome the anxiety arising from the intensity of the negotiation process and look for favorable conditions for both sides. This win-win effort requires ingenuity, flexibility and communication skills. If a negotiator realizes that he has settled on unfavorable conditions, he will try to assign the losses to the other party at the first opportunity. This situation makes it impossible to keep good relationships.

13. Conduct Further Research in the Areas of Weapon Procurement Risk, Negotiation and Project Management

This thesis has shown how difficult it is to assess risk, considering the interrelation between the components of risk, the "unknown unknowns," and the relevance of individual actors in the outcome of a procurement project. The experience of other countries can provide some hints about how to manage risk. However, the challenges and constraints are specific for a country and time period. Additionally, the results obtained by some countries in terms of risk handling have not been always successful. Studies made for the Chilean Navy, using tools ranging from game theory and simulation to behavior science, can enhance the chance for success of future projects.

14. Provide Better Training and Guidance to Project Managers

As mentioned in Chapter IV, Project Managers for major procurements do so only once in their career, so there is little chance for previous experience building. The most relevant activities in a project occur at its beginning, when Project Managers are just learning. Systematic knowledge and expertise should be kept in the form of guidance documents, experience records, previous cost estimations, past performance records for

various contractors. Using that knowledge in formal training courses and have it available to the Project Manager should accelerate the learning process.

15. Promote Information Sharing with Local Defense Industry, Foreign Contractors and Foreign Government Officials

Mutual understanding and cooperation are crucial for the success of the risky venture of weapon procurement. Information and experience gained by the Navy, like that contained in this thesis, should be shared with the other actors involved in the process. A shared base of knowledge will improve communications and understanding between the Navy and the other actors involved in procurement.

APPENDIX A. SUMMARY OF THE CONTRACT

A. INTRODUCTORY STATEMENT

For security reasons, the original contract cannot be disclosed. This summary is written for the purpose of this thesis and includes all the information needed for the analysis of contracting practices. Consequently, some technical details, dates and names have been omitted, modified or described in general terms.

This contract was signed between the Chilean Navy and the firm *"ALPHA"*[30], which would supply the Chilean Navy with all the equipment, documentation, training, supervision and support needed to install three missile systems type *"KILO"*. *"ALPHA"* was an aeronautical manufacturer, owned by the government of country *"OMEGA"*. "ALPHA" itself was going to have a minor direct participation as a supplier. Most of the equipment and services were going to come from its subsidiaries: *"ELECTRONICS"*, *"MISSILES"*, and *"TECHSERVICES"*.

The contract was negotiated, designed and managed by the Project Manager for Project "Kilo"[31], and signed by the General Director of Logistics.

The installation on board was going to be performed by Navy Shipyards in Chile, under the supervision of ALPHA. Navy Shipyards had no contract with the Chilean Navy for this purpose. The work was included in the Five Year Ship Maintenance Plan, and the resources to deal with the Shipyard were assigned to Project "KILO".

B. THE CONTRACT

Definitions:

Customer/Buyer:	The Chilean Navy
Seller/Vendor/:	"OMEGA ALPHA AERONAUTICS, hereinunder ALPHA."

---

[30] This and other names in this paragraph (which appear in italics) are used instead of the real ones throughout this thesis.

[31] The organizational details are discussed in Chapter 3.

System:	"Kilo" Mk 1 Missile System.
Subsystems and Units:	Parts of the System.(Description omitted.)
Test Equipment:	Missile Shore Test Equipment, Missile Simulator and Control System Test Equipment.
Equipment:	System and test equipment.
Ships:	The three ships in which the system is to be installed.
NPRO:	Navy representative in country OMEGA for this contract.
EDC:	Effective date of the contract.

Agreement:

Whereas ALPHA and its subsidiaries are developing the Kilo Mk 1 missile system for the Government of country OMEGA and the Chilean Navy seeks to purchase from ALPHA, and ALPHA has agreed to sell to the Chilean Navy the Kilo Mk 1 missile system, as well as documentation, test equipment, technical assistance, supervision and training the parties hereto has agreed as follows:

ARTICLE 1 OBJECT OF THIS AGREEMENT.

ALPHA undertakes to sell and deliver to the Chilean Navy and the Chilean Navy undertakes to purchase, receive and pay for the Equipment, Documentation and Services detailed in Article 2, in accordance with the terms, price, conditions and procedures set forth in this Agreement.

ARTICLE 2 DESCRIPTION OF THE EQUIPMENT, DOCUMENTATION AND SERVICES.

2.1 Three Kilo Mk 1 missile systems, composed by:

Radars, Control Systems, Launchers, Missiles, Test Equipment, Training for operation and maintenance, Documentation, Supervision for installation performed by the Chilean Navy and Setting to Work performed by ALPHA. (Details omitted)

2.2 Technical specifications for the system, subsystems and units, hereto and herein "the equipment" are included in exhibit "2A" (Omitted).

Manufacturing, assembly, inspection, quality control, training and documentation will be performed under the same standards and practices applied by ALPHA in the manufacturing, assembly, training and documentation of the same or similar equipment for the Navy of country OMEGA.

2.3 Kilo Mk 1 missile system is a stand alone system and operates in an integrated and automated manner. It does not require external sensors or input data other than those listed in exhibit "2B" (Omitted)

ARTICLE 3 PRICES[32]

3.1 In consideration for ALPHA's undertaking under this contract, except where a separate consideration is otherwise provided for, the Chilean Navy shall pay ALPHA for the equipment as described in Article 2 as follows:

3.1.1	Control Systems:	
	For each one of the systems:	US$ 26,396,000
	Total for the three systems:	US$ 79,188,000
3.1.2	Missiles:	
	For each missile:	US$ 216,000
	Total for 72 missiles	US$ 15,552,000
3.1.3	Simulators:	
	For each simulator:	US$ 100,000
	Total for three simulators:	US$ 300,000
3.1.4	Launchers:	
	For each launching system	US$ 422,000
	Total for three systems	US$ 1,266,000
3.1.4	Test Equipment:	
	Total for test equipment	US$ 3,564,000
3.1.5	Training:	
	Total for training	US$ 700,000
3.1.6	Documentation:	
	Total for documentation	US$ 1,414,000
3.1.6	Supervision Services	
	Total for Supervision Services	US$ 1,122,000
	TOTAL CONSIDERATION	**US$ 103,106,000**

[32] Prices and quantities have been changed for security reasons.

Note: All prices for the equipment are Ex-Factory prices.

3.2 In addition to the Total Consideration, the Chilean Navy shall pay to ALPHA price adjustments in accordance with the price adjustment formula set forth in exhibit "3A" hereto.

It is agreed that the price adjustment on any item of Equipment which is delayed as defined in Article 7 will be frozen on the date at the end of the period of grace as defined in said Article 7.

3.3 For a period of one year after EDC, the Chilean Navy shall have the option to place an order for additional Equipment at the unit prices set under Sub-Article 3.1 above, as adjusted under the price adjustment formula herein.

The times for payment and delivery schedule, as well as any additional service (such as interfacing) will be as separately negotiated by the Parties.

All of other terms and conditions of this agreement relating to Delivery and the Equipment (i.e., Article 2, 6-10, 13, 15-22 and 24) shall apply mutatis mutandis to such order.

ARTICLE 4 TERMS OF PAYMENT AND FINANCING

4.1 Terms of Payment

4.1.1 Sixty percent of the total consideration set forth in article 3.1 above i.e. the sum of US$ 61,863,600 shall be paid by the Chilean Navy to ALPHA as follows:

(a) Five percent (5%) of the Total Consideration i.e., US$ 5,155,300, as a non-refundable deposit upon the Effective Date of this Contract;

(b) Nine percent (9$) of the Total Consideration i.e. US$ 9,279,540 , within 12 months of the Effective Date;

(c) Twenty-one percent (21%) of the Total Consideration i.e., US$ 21,652,260, within 24 months of the Effective Date;

(d) Eighteen percent (18%) of the Total Consideration e.i., US$ 18,559,080 , within 30 months of the Effective Date;

(e) Seven percent (7%) of the Total Consideration i.e., US$ 7,217,420 , within 36 months of the Effective Date;

4.1.2 The balance of the forty percent of the Total Consideration set forth in Article 3.1 above, e.i., the sum of US$ 41,242,400 , shall be paid by the Chilean Navy to ALPHA as follows:

(a) The balance of the 40% of the price of each Subsystems/Unit (other than Kilo Mk 1 missiles and Test Equipment) shall be paid as follows:

(1) 30% upon Delivery of said Subsystem or Unit.
(2) 5% upon completion of the Harbour Acceptance Tests defined on the SOW on the ship containing said Subsystem or Unit.
(3) The remaining 5% upon completion of the Sea Acceptance Tests defined in the SOW on the ship containing said Subsystem or Unit.

(b) The remaining 40% of the price of each Kilo Mk 1 missile upon delivery of said missile.

(c) The remaining 40% of the price of the Test Equipment shall be paid as follows:

(1) 30% upon delivery of said Test Equipment.
(2) 10% upon completion of the Harbour Acceptance Tests as defined on the SOW on the first ship containing the System.

(d) The remaining 40% of the price of the Training shall be paid as follows:

(1) 30% upon the commencement of the first Training course.
(2) 10% upon completion of the last Training course.

(e) The remaining 40% of the price of the Documentation shall be paid as follows:

(1) 30% upon the commencement of the delivery of the Documentation.
(2) 10% upon completion of the delivery of the Documentation.

(f) The remaining 40% of the price of the Supervision services shall be paid as follows:

(1) 30% upon completion of the Sea Acceptance Tests of the first ship.
(2) 10% upon completion of the Sea Acceptance Tests as defined on the SOW on the last ship containing the System.

Note: In the event that Factory, Harbor or Sea Test or Inspection of the second or third ship is postponed (not due to fault of ALPHA), for a period greater than 90 days, the Chilean Navy shall pay to ALPHA the payments as set forth in 4.1.2(a)(2); 4.1.2(a)(3) and 4.1.2(f)(2).

These payments shall be due 90 days after the dates defined in the Test Detailed Program provided in exhibit "4A"(Omitted).

4.2. Amount due in respect of price adjustment under Article 3.2, shall be paid by the Chilean Navy together with the respective payment of the Total Consideration to which such price adjustment relates. ALPHA shall forward to the Chilean Navy its invoice for each payment due hereunder prior to the applicable payment date.

4.3. Financing : The total amount payable under Article 4.1.1 (a) to (e) and 4.1.2 (a) to (f) above (e.i., US$ 103,106,000)as well as the amounts payable for price adjustments under 4.2 above shall be financed in accordance with the finance agreement entered into between the Chilean Navy and ALPHA.

4.4 All payments hereunder shall be effected in net, freely transferable United States of America Dollars, free of any income, withholding or other taxes (other than ALPHA's income taxes), levies, duties or assessments which may be imposed by any government or governmental body or authority.

ARTICLE 5 DELIVERY AND PROGRAM SCHEDULE

5.1 The Program Schedule shall be as set forth in detail in exhibit "5A" hereto with Sellers first significant program milestone being presentation for FAT of the first KILO Mk 1 Weapon System at 36 months after the EDC.

5.2 The Delivery due dates will be determined as follows:

For the equipment: Upon signature of the respective Certificate of Acceptance.

For Miscellaneous Installation Material: Upon shipment.

For Documentation: Upon signature of the applicable Certificate for the Documentation delivered.

For Training: Upon signature of the Certificate of Completion of Training.

For Supervision and Technical Support Services: Upon completion of said tasks.

5.3 Delivery Summary: In exhibit "5A".

5.4 ALPHA may make partial deliveries within lots for purposes of this Article 5 and Article 4 above.

ARTICLE 6 ACCEPTANCE TESTS AND INSPECTIONS

6.1 OBJECT

The object of the Acceptance/Inspection tests are to verify ALPHA's compliance with the technical specifications of the Equipment. There will be three types of tests:

- Factory Acceptance Tests (FAT) / Inspection.

- Harbour Acceptance Test (HAT) for first ship.

- Sea Acceptance Test (SAT) for first ship.

The HAT and SAT for the remaining two ships shall be performed by the Chilean Navy with the supervision of ALPHA.

6.2 Factory Acceptance Test and Inspection

6.2.1 Upon completion of the manufacture and assembly of a Subsystem (or Unit thereof) of the Equipment (except for the miscellaneous installation equipment), ALPHA shall present that Subsystem or Unit for FAT at ALPHA or its subcontractors plants in country OMEGA.

The FAT procedures, as well as general description and the technical characteristics (mechanical or electrical) of the Equipment to be tested, shall be provided by ALPHA to the Chilean Navy not later than 6 months before the delivery due date specified in Article 5 above for the first of each Subsystem/Unit of said Equipment.

The Chilean Navy shall provide to ALPHA its comments within 2 months following receipt of said procedures.

Should ALPHA and the Government fail to agree in the FAT procedures, then the parties shall submit the dispute issue to technical arbitration in accordance with Sub-Article 13.3.

6.2.2 ALPHA shall give the Chilean Navy 20 days prior notice in writing of the date and place for the presentation of each Subsystem/Unit for FAT in order to enable the Chilean Navy to dispatch its NPRO to observe the FAT, and ALPHA undertakes to present that subsystem/Unit for FAT and to commence the FAT on the date specified or within 10 days thereafter.

6.2.3 Upon satisfactory completion of the FAT, ALPHA or its subcontractor shall sign, together with the NPRO present, if any, a Certificate of Acceptance confirming that the Subsystem/Unit has satisfactorily passed the FAT, thereby testifying that such Subsystem/Unit has been delivered and accepted by the Chilean Navy.

6.2.4 It is hereby agreed by the parties that, should the Chilean Navy notify ALPHA in writing that the Chilean Navy shall not exercise its right to observe any FAT, or should the NPRO fail to be present at the FAT on the date specified or within 10 days thereafter, through no fault of ALPHA, the sole signature of the Certificate of Acceptance by ALPHA shall be conclusive evidence that the Subsystem/Unit has satisfactorily passed the FAT and was delivered and accepted by the Chilean Navy. In such case, ALPHA shall forward to the Chilean Navy a copy of the Certificate of Acceptance.

6.2.5 The miscellaneous installation material (MIM) shall be presented for Inspection pursuant to ALPHA's subcontractor's standard procedures for Inspection. Upon satisfactory completion of Inspection in respect of a MIM set, ALPHA shall issue an "Inspection Certificate" confirming that the MIM has passed the Inspection, thereby testifying that such MIM has been delivered to and accepted by the Chilean Navy.

6.2.6 Upon signature of the Certificate of Acceptance/ Certificate of Inspection in accordance with the provisions of 6.2.3, 6.2.4 or 6.2.5 above, title and risk of loss of the respective Subsystem/Unit shall pass to the Chilean Navy (hereinafter "Delivery").

6.2.7 The cost of performing the FAT and Inspections in country OMEGA shall be borne by ALPHA. Should any Subsystem or Unit of the Equipment fail its FAT or Inspection, ALPHA will conduct repeat FAT or Inspection at ALPHA's expense.

The cost and expenses of the NPRO participating in the FAT shall be borne by the Chilean Navy.

6.3 Harbour Acceptance Tests ("HAT") and Sea Acceptance Tests ("SAT")

6.3.1 ALPHA will forward to the Chilean Navy, 6 months prior to the start of the HAT of the first ship, the procedures for the HAT and SAT. The Chilean Navy shall forward to ALPHA its comments within 2 months of following receipt of said procedures. Should ALPHA and the Chilean Navy fail to agree on the said procedures, then the Parties shall submit the dispute issue to technical arbitration in accordance with Sub-Article 13.3.

6.3.2 It is agreed by the Parties that should repeat HAT or SAT be require, then each Party shall, at its own expense, perform its respective tasks and furnish the equipment, manpower, facilities and services necessary for such repeat tests. Each Party further agree not to claim any compensation from the Party causing such repeat tests.

6.3.3 Upon satisfactory completion of the HAT and SAT respectively ALPHA shall sign together with the Chilean Navy representative a Certificate of HAT completion and SAT completion in the form set out in hereto (hereinafter "Certificate of Acceptance").

ARTICLE 7. COMPENSATION FOR DELAYS

Should ALPHA fail, other than for reasons set forth in Article 8 below, to Deliver any Subsystem/Unit of the Equipment on the date specified in Sub-Article 5.3. above, ALPHA shall pay to the Chilean Navy, as and for liquidated damages (whether in the contract or law) suffered by the Chilean Navy, for the delay in Delivery of such Subsystem/Unit, a sum calculated at the rate of 0.5% of the price of the Subsystem/Unit so delayed per month of delay beyond a grace period of:

(i) For lot No.1 under Sub-Article 5.3, 120 days.

(ii) For other lots under Sub-Article 5.3, 90 days up to a maximum of 6% of the price on any such delayed Subsystem/Unit.

ARTICLE 8. FORCE MAJEURE

8.1 ALPHA shall not be held responsible for any delay or failure in the performance of its obligations under this Agreement, when the delay or failure arises from a cause which is beyond the control of ALPHA or which arises without ALPHA's fault or negligence and affects the execution of this Agreement.

8.2 The causes referred to in Par. 8.1 include, but are not limited to, any one of the following:

Acts of God, fortuitous cases, war or state of war, insurrections, riots, any act of government (including such act which concerns any type of priorities, assignments or social disorders), accidents, fire, explosion, inundations, natural violent phenomena, catastrophes, epidemics, quarantine, meteorological condition which do not allow the execution of the tests or other obligations hereunder.

8.3 An event under 8.2 affecting the ALPHA subcontractors of any tier will be deemed a Force Majeure of ALPHA.

8.4 ALPHA shall inform the Chilean Navy within 30 days from the day such case occurs and ALPHA becomes aware of the same, describing the antecedents on which it bases its claim and indicating the known effects of the case on the Contract execution.

8.5 The Party affected by the Force Majeure will do everything possible to minimize the delays and continue to carry-out the Contract until the elimination of the cause of the delay.

ARTICLE 9. TERMINATION

9.1 Should a delay in delivery of any Subsystem/Unit of the Equipment exceed twelve months beyond the grace period under Article 7 above (for reasons other than Force Majeure), the Chilean Navy shall have the right, in respect of such Subsystem/Unit which ALPHA has failed to deliver, to notify ALPHA of the cancellation of the purchase of said Subsystem/Unit under this Agreement, in which event ALPHA shall, as the Chilean Navy sole remedy, return to the Chilean Navy all of the amounts paid in respect of said Subsystem/Unit.) as escalated in accordance with Exhibit "3A" hereto to the date of payment by ALPHA.

9.2 Should, as a result of a Force Majeure affecting ALPHA, a delay in Delivery for any Subsystem/Unit of equipment exceed 12 months beyond the grace period under Article 7 above, the Chilean Navy shall have the right, in respect of that Subsystem/Unit that ALPHA has failed to deliver, to notify ALPHA of the cancellation of the purchase of said Subsystem/Unit under this Agreement, in which event, the Chilean Navy shall be required to pay to ALPHA an amount equal to ALPHA actual costs expended, incurred or committed in connection with such cancelled Subsystem/Unit. Should the Parties fail to agree on the amounts of said actual costs of ALPHA, the issue in dispute may be submitted for resolution to arbitration under Sub-Article 13.2 below.

ARTICLE 10 WARRANTY

10.0 ALPHA thereby warrants that, at the time of Delivery, the Equipment will be free from defects in materials and workmanship.

10.2 With respect to each item of Equipment sold hereunder, ALPHA shall repair or replace, at ALPHA premises in country OMEGA any defective part(s) of the item which is/are demonstrated to ALPHA satisfaction to have been defective at Delivery, provided that:

10.2.1 In respect of the System, (except missiles), such defect in material and workmanship is discovered within 18 months from completion of FAT or 1 year after completion of HAT whichever comes earlier; and

10.2.2 In respect of Test Equipment, and KILO mk 1 Missiles, such defect in material and workmanship is discovered within 18 months of delivery of the same; and

10.2.3 The Chilean Navy gives ALPHA written notice within 30 days of the discovery of such defect and within the limit as aforesaid; and

10.2.4 In respect of the KILO Mk 1 missile, the missile has not been fired.

10.3 ALPHA shall have no obligation unless the item and/or the defective part(s), as the case may be, has/have been installed, operated, handled, maintained, stored and repaired in accordance with the current recommendations of ALPHA as stated in its manuals and/or other written instructions, and provided that said item and/or defective part(s) has/have not been subject to accident, abuse, misuse or misapplication.

10.4 At ALPHA's request, the Chilean Navy will ship the defective part(s) to a location designated by ALPHA; it being understood that the Chilean Navy shall bear the shipping costs for defective part(s) to country OMEGA and ALPHA shall pay for the return shipping cost to Chile of the repaired or replaced part(s) which qualify for warranty repair/replacement hereunder. Any part which is replaced will become property of ALPHA. The provisions of this Warranty shall apply to the replacement repaired part(s) for the unexpired portion, if any, of the applicable time period set forth in 10.2 above. Life limited items shall be warranted on a pro-rata credit basis.

10.5 ALPHA warrant that the Documentation shall be complete and up-to-date to the time of Delivery. ALPHA shall, during a period of 12 months from Delivery of any Documentation, correct or complete such Documentation if it does not conform to the above warranty.

10.6 THIS WARRANTY IS EXHAUSTIVE AND EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED. WARRANTIES OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR PURPOSE ARE EXCLUDED. ALPHA SHALL NOT BE LIABLE FOR ANY CONSEQUENTIAL DAMAGES AND/OR LOSSES AND THE EXTENT OF ALPHA'S LIABILITY SHALL NOT EXCEED THE COST OF REPAIRING OR REPLACING (AT ALPHA'S OPTION) SUCH DEFECTIVE PART(S) AS AFORESAID.

ARTICLE 11 DOCUMENTATION

11.1 ALPHA undertakes to supply to the Chilean Navy the documentation at the times set forth in exhibit "5A", as follows:

Operator Manuals

Technical Manuals including:

- Technical Description
- Diagrams
- Maintenance Manuals
- Parts Catalogues

Test Equipment Manuals

11.2 In addition to the documentation set forth in 11.1 above, ALPHA will supply software documentation at the times set forth in exhibit "5A".

11.3 In addition to the documentation set forth in 11.1 and 11.2 above is herein referred as the "Documentation". The Documentation shall be in English language.

11.4 Upon delivery by ALPHA to the Chilean Navy of the first set of any Documentation, the Chilean Navy shall sign and deliver to ALPHA a certificate of commencement of Documentation Delivery (hereinafter referred as to "Certificate of Commencement of Documentation Delivery"). Upon delivery by ALPHA to the Chilean Navy of additional Documentation (but not the final Documentation), the Chilean Navy shall sign and deliver to ALPHA a "Certificate of Receipt of Documentation".

11.5 Upon delivery by ALPHA to the Chilean Navy of the last of the Documentation, the Government shall sign and deliver to ALPHA a "Certificate of Receipt of Entire Documentation".

11.6 ALPHA undertakes to provide the change pages to the Documentation supplied under this contract to accommodate the modification(s) as stated in Article 14.

11.7 The Documentation is given solely for the installation, operation, maintenance and repair of the Equipment by or for the Chilean Navy, and rights of manufacture or otherwise are not granted hereunder.

11.8 All the Documentation shall be in English Language, and in the format set forth in exhibit "11A"(Omitted).

ARTICLE 12 SPARE PARTS, TRAINING, TECHNICAL ASSISTANCE AND OTHER SUPPORT

12.1 SPARE PARTS

12.1.1 ALPHA will provide to the Chilean Navy, within 10 months of the EDC, a list of spare parts for the KILO Mk 1 Weapon System. Said list shall list will be divided into on-board and depot spares and shall detail the manufacturers part number, NATO/Federal Stock number (if available to the seller) prices recommended quantities for a two year period of Equipment operation, which shall have aggregated price, based on accepted standards, of approximately 10% the price of the Equipment ordered hereunder. ALPHA shall, in the preparation of the list, take into account its experience in manufacturing naval systems, the maintenance concept and the operational profile of the equipment (to be provided by the Chilean Navy 6 months after the EDC).

12.1.2 ALPHA undertakes, for a minimum period of 10 years from the date of completion of the FAT on the last System, to supply to the Chilean Navy Equipment spare parts at prices and upon other conditions to be mutually agreed upon by the Parties. Such prices must be fair and reasonable taking into account quantities, lead time, terms of payment, etc.

12.1.3 Those Spare Parts that require programming or software loading will be supplied with such programming or software loading, after been tested by ALPHA.

12.2 TRAINING

12.2.1 ALPHA shall provide the Chilean Navy, in country OMEGA and in Chile, with training courses for the Chilean Navy's personnel. All courses will be in English language.

12.2.2 A detailed description of the aforementioned training courses, the commencement dates and duration thereof, and the number and qualification of the trainees designated by the Chilean Navy to participate therein, are set forth in exhibit "12A" (Omitted) attached hereto.

12.2.3 Upon commencement by ALPHA of the first course of the Training, the Chilean Navy shall sign and deliver to ALPHA a "Certificate of Commencement of Training".

12.2.4 Upon completion of the last training course, the CHILEAN Navy shall sign and deliver to ALPHA a Certificate of Completion of Training.

12.2.5 All expenses and costs of the Chilean Navy's trainees in country OMEGA, including but not limited to salaries, travel and transportation expenses, per diem, living expenses, and social security, medical and other insurance costs, shall be borne by the Chilean Navy.

12.2.6 All expenses and costs of ALPHA's instructors in Chile, included to salaries, travel and transportation expenses, per diem, living expenses, and social security, medical and other insurance costs, shall be borne by ALPHA.

12.2.7 If requested by the Government, ALPHA shall provide to the Chilean Navy, at prices and upon terms and conditions to be mutually agreed upon by the Parties, the following additional support.

(i) Extension of training courses and/or additional training courses for the engineers and/or technicians of the Chilean Navy.

(i) Additional technical assistance in respect of the operation, maintenance and support of the Equipment purchased hereunder.

12.3 SHIP SURVEY, ICIT, AND TEST EQUIPMENT INSTALLATION TASKS

12.3.1 Ship Survey and ICIT (Installation, Check-out, Integration and Test).

(1) ALPHA and the Chilean Navy shall perform the survey of the ships and the ICIT, including HAT and SAT of the KILO Mk 1 Weapon System on board the three ships selected for that purpose, all as set forth in the Statement of Work attached hereto as Exhibit "12B" (the "SOW").

(2) The Chilean Navy and ALPHA undertake to carry out their respective tasks, as set forth in Exhibit "12B" and the Program Schedule as established thereunder.

(3) Upon completion by ALPHA of its tasks in respect of the ICIT of each ship, ALPHA shall sign and deliver a "Certificate of Completion of ICIT Task".

12.3.2 Test Equipment Installation Tasks

(1) ALPHA and the Chilean Navy shall at the times specified in the Program Schedule perform the tasks as described in the SOW for the installation and check out of the KILO Mk 1 Missile Test Equipment.

(2) Upon completion by ALPHA of its tasks in respect of the KILO Mk 1 Missile Test Equipment, ALPHA shall sign and deliver to the Chilean Navy a "Certificate of Completion of KILO Mk 1 Missile Test System Tasks".

12.3.3 Chilean Navy Support and General

(1) In order to enable ALPHA to perform properly its undertakings under 12.3.1 and 12.3.2 above, the Chilean Navy undertakes, upon ALPHA's request, and at no charge to ALPHA,

(a) To provide the necessary work permits, entry and residents visas (including for members of their families) and security clearances for all the ALPHA and its subcontractor's personnel in order to enable said personnel to commence their work on time and to continue such work for as long as required;

(b) To provide suitable manpower, equipment, tools and facilities as described in the SOW, in order to assist and support ALPHA in the performance of its obligations and undertakings under this Article; provided that none such Chilean Navy supplied manpower shall for any reason be deemed employees, agents or contractors of ALPHA.

(c) To provide ALPHA with office accommodations, telephone (local calls only), and telex services.

(d) To cause to be issued all of the necessary exemptions and/or permits and/or other documents required in order to exempt the said ALPHA and its subcontractor's personnel from any and all Chilean income and other taxes (federal, state and municipal); and

(e) To make its best efforts to provide ALPHA with all such other assistance as shall be required by ALPHA for its performance hereunder.

(2) Except as stated in (2) (a) below, all travel and transportation costs, living expenses, per diem, salaries, medical expenses and insurance of said personnel shall be borne by ALPHA.

(a) In the event that any ALPHA/subcontractor personnel hereunder is required, in order to render services pursuant to this Agreement:

(i) If the person must travel within different cities within Chile out of his/her city of residence, the Chilean Navy shall provide, at no charge to ALPHA, airline tickets or other suitable means of transportation, as well as lodging, food and reasonable travel expenses for the duration of his/her travel. It is understood that ALPHA will determine the original place of residence of the personnel in consultation with the Chilean Navy.

(ii) To change his town of residence within Chile, the Chilean Navy shall provide him/her, at no charge for ALPHA, with airline tickets or other suitable means of transportation to such new place of residence, and the Chilean Navy shall reimburse ALPHA for all dislocation and relocation costs (inclusive of the costs of transporting personal effects and cancelling of housing leases, if applicable).

(b) The living expenses and dislocation/relocation expenses referred to in (2) (a) above shall be paid by the Chilean Navy to ALPHA within 30 days of the Chilean Navy's receipt off the invoice therefor.

12.3.4 It is understood and agreed that each of ALPHA subcontractor personnel:

(a) Shall not be obliged to work more than 8 hours per day on Monday through Friday inclusive; and

(b) Shall not work on Saturdays, Sundays and on OMEGA's national holidays.

12.3.5 The Chilean Navy undertakes to use its best efforts to facilitate the removal by ALPHA from Chile of all ALPHA and its subcontractors owned equipment utilized during and for the performance of ALPHA's undertakings under this Agreement.

ARTICLE 13 ARBITRATION

13.1 The parties shall endeavor to settle in a direct and friendly manner any difficulty, controversy, or lack of agreement which may arise in connection with this Agreement.

13.2 Subject to 13.3 below, if said difficulties cannot be settled in said manner, they shall at the request of either Party, be referred to arbitration in front of two arbitrators, one selected by ALPHA, and the other by the Chilean Navy (provided said individuals shall have necessary security clearance). If the arbitrators can not reach a decision due to lack of agreement, they will by mutual agreement select a third arbitrator who will resolve only the issues in dispute. The arbitration will be administered in accordance with the Rules of Arbitration and Conciliation of the International Chamber of Commerce and will be held at a location agreed upon by the arbitrators (or if they do not agree, in Geneva Switzerland).

The arbitration will be held in the English language. The arbitrator's decision shall be final and binding on the Parties hereto.

13.3 In the technical matters set forth in the Articles 6.2 and 6.3 which are in dispute between the Parties, ALPHA agrees that such disputes shall be referred to for decision to a technical arbitrator appointed by the Commander of the OMEGA Navy.

ARTICLE 14 KILO MK 1 WEAPON SYSTEM DEVELOPMENT AND TECHNICAL MODIFICATIONS

14.1 Technical specifications

14.1.1 The prices appearing in this Agreement are for the supply of the Equipment, services and Training according to the Technical Specifications attached to this Agreement which are defined as on the date of the signature of this Agreement. The changes (if any) resulting from the development tests as well as from the sea tests planned for July 19N2 (precise date omitted), in order to meet the specifications herein, shall be introduced at no cost to the Chilean Navy.

14.1.2 ALPHA undertakes, subject to the Defense Authority (DA) of country OMEGA approval, to notify the Chilean Navy of the modifications that have been introduced to equipment identical to the Equipment supplied under this Agreement and make available to the Chilean Navy (if and when the Chilean Navy requests, at terms and conditions to be agreed upon and subject to DA approval), the parts and the services necessary to introduce the said modifications to the Equipment.

14.1.3 ALPHA undertakes to include without any additional cost to the Chilean Navy modifications which according to ALPHA will be necessary for safety reasons.

14.2 KILO Mk 1 Weapon System Development

14.2.1 To meet the requirements to keep the Chilean Navy informed and updated on the progress of the development of the KILO Mk 1 Weapon System being carried out by ALPHA under Agreement with the DA, ALPHA agrees as follows:

(1) ALPHA agrees that the Chilean Navy is entitled to have its representative present to witness several important events in the development trials and tests of the KILO Mk 1 Weapon System, subject to coordination with DA. The current development Program includes the following trials/tests series:

TENTATIVE SCHEDULE (subparagraphs omitted)

The Chilean Navy is entitled to witness one major event in each of the above series.

(2) ALPHA shall notify the Chilean Navy of any changes in the tentative schedule and the develop of the trial/test program.

(3) ALPHA shall notify the Chilean Navy, at least 30 days prior to commencement of the trial/test event to be witnessed, of its date, location and program. 4 days prior to the date, ALPHA will confirm to the Chilean Navy the final schedule for the event.

(4) ALPHA shall submit to the Chilean Navy a summary report of the trial/test event witnessed by the Chilean Navy within three months after performance of same.

(5) The cost and expenses of the Chilean Navy representative participating in the said trial/tests shall be borne by the Chilean Navy. ALPHA shall bear no responsibility or obligation for any expense incurred by the Chilean Navy resulting from delay, cancellation, or any other change in the trial/tests.

14.2.2 In the event that (due to major delays or failures in the development trial/tests program caused by ALPHA's fault) it becomes apparent that ALPHA will be delayed in the delivery of the first KILO Mk 1 Weapon System to the Chilean Government by more than 16 months, the Chilean Navy will be entitled to require ALPHA to

submit a proposed equitable solution to the anticipated delay. Should the Parties, after reasonable efforts, fail to reach mutual agreement on such an equitable solution, the Chilean Navy will be entitled to terminate part or all of the deliverables hereunder in accordance with Sub-Article 9.1 above.

ARTICLE 15 PACKING

15.1 Upon the delivery to the Chilean Navy, of each Subsystem/Unit of the Equipment, ALPHA or its subcontractors shall properly pack such Subsystem/Unit for maritime/air shipment and shall, if requested by the Chilean Navy and at the Chilean Navy's risk and expense, ship same to Chile. The Chilean Navy shall be responsible for insuring such shipments (if such insurance is deemed necessary by the Chilean Navy).

15.2 Notwithstanding the provision of 15.1 above, ALPHA undertakes to transport the Equipment, at ALPHA's risk and expense, to a country OMEGA's port of exit.

ARTICLE 16 LIMITATION OF LIABILITIES

16.1 The Chilean Navy shall, whether in contract, law or otherwise, have no recourse against ALPHA and shall defend, and indemnify and hold ALPHA harmless against any claims for any loss (inclusive of personal injury or death), liability, damage or cost which may at any time be suffered or incurred by the Chilean Navy and/or third party by reason or consequence of, or in connection with the sale and/or purchase and/or handling and/or maintenance of the Equipment supplied hereunder and/or use and/or other services performed by ALPHA incident hereto.

16.2 The Chilean Navy shall have no liability whatsoever for any damage to either ALPHA or ALPHA's personnel as a consequence of the Chilean Navy's use, handling and/or maintenance of the Equipment supplied under this Agreement.

16.3 As used in 16.1 and 16.2 above, the term "Chilean Navy" shall mean the Chilean Navy, its contractors, and their respective personnel, agents, officers, employees, suppliers and subcontractors; and the term "ALPHA" shall mean ALPHA, its subsidiaries, and their respective personnel, agents, officers, employees, suppliers and subcontractors.

ARTICLE 17 LICENSES AND TAXES

17.1 Licenses

17.1.1 ALPHA shall be liable for and undertake, at its sole expense and responsibility, to deal with all the formalities required and to procure all the required licenses and

permits from all the competent authorities of the Government of OMEGA for the implementation of ALPHA's obligation hereunder and/or for the export from country OMEGA of the Equipment sold hereunder.

17.1.2 The Chilean Navy shall be liable for and undertake, at its sole expense and responsibility, to deal with all the formalities required and to procure all the required licenses and permits from all the competent authorities of all other countries, including the Republic of Chile, for the implementation of Chilean Navy's obligation hereunder and/or for the import of the Equipment into the Republic of Chile.

17.2 Taxes

17.2.1 ALPHA shall be liable and pay all taxes, levies, duties, and assessments imposed by the Government of country OMEGA on the export from OMEGA of the equipment.

17.2.2 All other taxes, levies, duties, and assessments imposed on the equipment after their delivery, inclusive of those imposed in transit and/or their import into the Republic of Chile, shall be borne by the Chilean Navy.

ARTICLE 18 APPLICABLE LAW

This Agreement shall be construed and interpreted in accordance with the law of the state of New York.

ARTICLE 19 SECURITY AND CLEARANCE

19.1 Both Parties undertake not to divulge to any third party any information with regard to this Agreement or contained herein, nor to disclose the existence of this Agreement, except to their employers, contractors or subcontractors to the extent as may be necessary for the performance of this Agreement.

19.2 Any representative Nominated by the Chilean Navy for the performance of its undertakings or the exercise of its right under this Agreement in country OMEGA, shall be subject to prior security clearance by the security authorities of the government of country OMEGA.

19.3 In the same manner, any representative nominated by ALPHA for the performance of its undertakings or for the exercise of its rights under this Agreement in Chile shall be subject to prior security clearance by the security authorities of the government of Chile.

ARTICLE 20 LIMITATIONS OF USE AND END USER RESTRICTIONS

20.1 Limitations of Use

The Chilean Navy hereby acknowledges and declares that it is purchasing the Equipment and Documentation solely for its own use and that it will be the sole end user of the Equipment. Accordingly, the Chilean Navy undertakes that it will not, either directly or indirectly, sell, assign, transfer, convey, or in any manner dispose of the Equipment and Documentation, or any part thereof, to other person, company, entity, government, state or other party.

20.2 End User Restrictions

20.2.1 ALPHA declares that the Equipment (and Subsystem/Unit thereof), as well as Spare Parts under 12.1.1 above, sold hereunder to the Chilean Navy do not require approval of any government, other than the government of country OMEGA.

20.2.2 ALPHA further declares that the government of country OMEGA has approved the sale of the Equipment hereunder to the Chilean Navy.

ARTICLE 21 ASSIGNMENT

Neither party shall have the right to assign or otherwise transfer its rights or obligations under this Agreement without the written consent of the other Party.

ARTICLE 22 NOTICES AND CORRESPONDENCES

22.1 Any notice required to be given by either Party to the other hereunder shall be in writing and shall be delivered personally, or by registered or certified mail, or by facsimile or telex, to the other Party. Notice shall be deemed effected upon receipt of said of said written notification by the Party to whom the notice is sent, or, in the case of mailing, within 15 days after the mailing of the same.

22.2 All notices shall be effected as follows:

To the Chilean Navy : (Addresses in Chile and in country OMEGA omitted.)

To ALPHA : (Addresses in Chile and in country OMEGA omitted.)

ARTICLE 23 ON SITE REPRESENTATIVES, VISITS AND PROGRESS REVIEWS

23.1 On site Representative (NPRO)

23.1.1 The Chilean Navy shall have the right to station at ALPHA's premises a representative to monitor the progress of the work under the Agreement, including quality control activities (hereinafter referred to as "Navy Plant Representative Officer", or "NAPRO").

23.1.2 ALPHA shall provide said representative, at no cost to the Chilean Navy with office space, telephone (local calls only), telex and secretarial services.

23.1.3 The Chilean Navy shall notify ALPHA four months in advance of the arrival of the NAPRO of the name and details of its proposed representative, in order to enable security and administrative clearance and arrangements.

23.1.4 The representative shall perform his functions on a non-interference basis and shall be subject to the security regulations of the government of country OMEGA and ALPHA.

23.1.5 All salary, travel, per diem, insurance and other costs and expenses of the NAPRO shall be borne by the Chilean Navy.

23.2 Visits

23.2.1 The Chilean Navy shall have the right to have a reasonable number of its representative/s visit ALPHA's premises for limited periods of time in order to observe the progress of the work. Such visits shall be coordinated in advance with ALPHA.

23.2.2 The provisions of 23.1.4 and 23.1.5 above shall apply to such visits and representatives.

23.3 Program Progress Reviews

23.3.1 The Parties agree to hold periodic program progress reviews approximately every 6 month or as otherwise agreed to by the Parties. The program reviews shall be held alternately in country OMEGA and in Chile.

23.3.2 Each Party shall bear the costs and expenses of its participants in such program reviews.

ARTICLE 24 MISCELLANEOUS

24.1 Non waiver

The failure of either Party to insist in any or more instances upon strict performance of any of the terms of this Agreement or to exercise any rights conferred herein shall not be construed as a waiver or relinquishment to any extent of either Party's right to assert or rely upon any such term or right on any future occasion.

24.2 Language

All correspondence, information, specifications, reports, notices and any other written or oral communication between the Parties shall be in English or Spanish. In technical matters English will be used.

24.3 Captions

The title heading of the Articles hereof are intended solely for convenience of reference and are not intended and shall not be construed for any purpose whatever as in any way limiting or extending the language of the provisions to which the captions refer.

24.4 Reciprocal Assistance

Each Party shall assist the other Party's personnel performing services and/or exercising rights in accordance with the provisions of this Agreement in the opposite Party's country, in obtaining lodging, internal transportation and food, and in dealing with other reasonable requirements of such personnel.

24.5 Entire Agreement

The terms and conditions of this Agreement constitute the entire Agreement between the Parties hereto and shall supersede all previous communications, representations or agreements, whether oral or written, between said Parties, with respect to the subjects matter hereof. Any amendment to this Agreement must be in writing and signed by both Parties.

ARTICLE 25 EFFECTIVE DATE

This Agreement shall enter into effect upon the date of the last of all of the following effects, provided that all such events occur by no later than 31 October 19N0 (Precise date omitted).

a.- Approval of the Agreement by a "Decreto Supremo" of the government of Chile.

b.- Signature of the Agreement by both Parties.

c.- The Finance Agreement has entered and remains into effect.

d.- Receipt by ALPHA of the Down payment, according to Sub-Article 4.1 of the Finance Agreement.

e.- Receipt by ALPHA of the Notes provided for in the Finance Agreement.

IN WITNESS HEREOF, the Parties hereto have signed this Agreement on the date first hereinabove recited.

THE CHILEAN NAVY	OMEGA ALPHA AERONAUTICS
By: _____	By: _____
Name: _____	Name: _____
Title: _____	Title: _____

EXHIBIT 3 A

PRICE ADJUSTMENT

The following Price Adjustment will apply to each Payment referred to in Sub-Article 3.2 of this Agreement.

$$D = P \times (0.4 \, {}^{Wn}/_{Wo} + 0.6 \, {}^{Mn}/_{Mo})$$

Where :

P = is the Payment amount due under this Agreement.

D = is the price adjustment due in respect of each basic Payment.

W = is the U.S. Index "Average Hourly Earnings - Production Workers (Sic 372 - Aircraft and Parts)" as published in the U.S. Department of Labor - Bureau of Labor Statistics.

M = is the U.S. Index "Producer Price Index for Industrial Commodities" as published in the U.S. Department of Labor - Bureau of Labor Statistics.

Wo = is the index "W" relating to November 1986 (i.e. US$ 13.11).

Mo = is the index "M" relating to November 1986 (i.e. 309.8, where 1967 average = 100).

Wn = is the index "W" relating the month which is four months prior to the date upon each Payment is due according to the provisions of this Agreement.

Mn = is the index "M" relating the month which is four months prior to the date upon each Payment is due according to the provisions of this Agreement.

EXHIBIT "5A"

DELIVERY SCHEDULE

LOT NUMBER	QUARTERS AFTER E.D.C.	QUANTITY	ITEMS INCLUDED	PRICE US$ x 1000
Ship Installation:				
1	12	1	Control system # 1	$26,396
		1	Launcher # 1	$422
2	15	1	Control system # 2	$26,396
		1	Launcher # 2	$422
3	18	1	Control system # 3	$26,396
		1	Launcher # 3	$422
Missiles:				
4	18	12	Missiles	$2,592
5	21	24	Missiles	$5,184
6	28	12	Missiles	$2,592
7	30	24	Missiles	$5,184
Simulators:				
8	15	1	Simulator # 1	$100
9	18	1	Simulator # 2	$100
10	21	1	Simulator # 3	$100
Test Equipment:				
11	16	1	Test Equipment	$3,564
Supervision:				
12	3	1	Supervision: Survey Report	
13	3	1	Supervision: Requirements Report	
14	6	1	Supervision: Installation Control Document	
15	4	1	Supervision: Interface Design Specification	
16	6	1	Supervision: Comments on Chilean Navy Design	
17	13	1	Begin Instalation Supervision 1st Ship	
18	17	1	End Instalation Supervision 1st Ship	
19	21	1	End Instalation Supervision Ships 2 & 3	
20	12	1	Installation Requirements for Test Equipment	
21	18	1	Begin Installation Supervision Test Equipment	
22	19	1	End Supervision Test Equipment	$1,122
Documentation:				
23	4	1	Recommended Spare Parts List	
24	12	1	Begin Delivery of Documentation	
25	20	1	Complete Delivery of Documentation	$1,414
Training:				
26	11	1	Begin Training	
27	16	1	Complete Training	$700
			TOTAL:	**$103,106**

Note: Alpha may make partial deliveries within lots for purposes of this Article 5 and Article 4 above

EXHIBIT "12 B"

STATEMENT OF WORK "S.O.W."

OMMITED

AMENDMENT No. 2 TO AGREEMENT

DATED JULY 24 19N0 BETWEEN

THE CHILEAN NAVY AND OMEGA ALPHA AERONAUTICS LTD.

FOR THE KILO Mk 1 WEAPON SYSTEM.

JULY 26, 19N4

SUMMARY:

ANNEX 1 (TECHNICAL)

ANNEX 2 (SCHEDULE)

ANNEX 3 (SOFTWARE PHASES)

ANNEX A (OMEGA NAVY DEVELOPMENT PROGRAM)

This amendment No. 2 is entered into by and between the Chilean Navy (the "Buyer") and OMEGA ALPHA AERONAUTICS LTD. (the "Seller") on this 26 day of July 19N4.

WITNESSETH

WHEREAS, the Parties entered into an Agreement dated July 24 19N0 for the purchase by the Buyer from the Seller, inter alia, of the KILO Mk 1 Weapon System (the "System") which was being developed by the Seller for and in coordination with OMEGA Navy (O.N.) (hereinafter the "Basic Agreement"), which Basic Agreement was previously amended by Amendment dated October 2, 19N2 for the purchase of additional KILO Mk 1 missiles (hereinafter referred to as "Amendment No. 1 to the Basic Agreement"); and

WHEREAS, during the Seller's aforesaid development program a number of changes and improvements to the originally defined System were and are being implemented by the Seller for the OMEGA Navy; and

WHEREAS, as a result, inter alia, of the above implementation activity, the aforesaid development program schedule has been extended and consequently the deliveries and schedule of the Basic Agreement have been delayed; and

WHEREAS, the Seller and the Buyer desire to amend and update the Basic Agreement in accordance with the terms of this Amendment No. 2 hereinafter set forth,

NOW THEREFORE the Parties agree as follows :

Section 1. Definitions

All terms used herein which are defined under the Basic Agreement shall have the same meaning hereunder as under the Basic Agreement, subject only to any modifications thereto under terms of this Agreement.

Section 2. Description of the Fire Control System and Fire Control Radar Subsystems

Omitted.

Section 3. Terms of Payment

3.1 The terms of payment under Sub-Article 4.1.2 of the Basic Agreement shall be modified only as set forth below. The term price as used hereinbelow shall mean the price under the Basic Agreement, subject to any adjustments applicable thereto under the terms of the Basic Agreement.

3.2 The following payment terms will apply to the balance of the 40% of the price of the Fire Control Systems (FCS) of lot No. 1 (described in Sub-Article 5.3) described in said Sub Article 4.1.2 of the Basic Agreement:

3.2.1 15% of the price of said FCS upon Delivery (as defined in the Basic Agreement) of same;

3.2.2 10% of the price of said FCS, upon delivery of the Block A software (as defined hereunder);

3.2.3 5% of the price of said FCS, upon Delivery of the Block B software (as defined hereunder);

3.2.4 5% of the price of said FCS, upon completion of the Harbour Acceptance Tests defined in the SOW on the ship containing such Subsystem.

3.2.5 The remaining 5% of the price of said FCS, upon completion of the Sea Acceptance Tests defined in the SOW of the ship containing said Subsystem.

3.3 The following payment terms will apply to the balance of 40% of the price of the FCS of lots Nos. 2 and 3 (described in Sub-Article 5.3 of the Basic Agreement) described in said Sub-Article 4.1.2 of the Basic Agreement:

3.3.1 25% of the price of the FCS of each lots Nos. 2 and 3, upon Delivery (as defined in the Basic Agreement) of the respective FCS;

3.3.2 5% of the price of the FCS of each of said lots Nos. 2 and 3, upon Delivery of the Block B software (as defined hereunder);

3.3.3 5% of the price of the FCS of each lots Nos. 2 and 3, upon completion of the H.A.T. defined in the SOW on the ships containing the respective FCS; and

3.3.4 The remaining 5% of the price of the FCS of each of said lots Nos. 2 and 3, upon completion of the S.A.T. defined in the SOW of the ships containing the respective FCS.

3.4 The following payment terms will apply to the balance of 40% of the price of the Fire Control Radar (FCR) of lots Nos. 1 and 2 (described in Sub-Article 5.3 of the Basic Agreement) described in said Sub-Article 4.1.2 of the Basic Agreement;

3.4.1 28.5% of the price of said FCR, upon delivery of the same.

3.4.2 1.5% of the price of said FCR, upon delivery of the FCR software supplement (as defined hereunder);

3.4.3 5% of the price of the FCR, upon completion of the Harbour Acceptance Tests defined in the SOW for the ships containing said Subsystems; and

3.4.4 The remaining 5% of the price of said FCR, upon completion of the Sea Acceptance Tests defined in the SOW for the ships containing said Subsystems.

Section 4. Delivery and Program Schedule

4.1 Exhibit "E" of the Basic Agreement shall be amended by the updated Exhibit "E" set forth as Annex "2" of this Amendment No. 2. Any milestones under the original Exhibit "E" which are not dealt with under the updated Exhibit "E" shall remain as set forth under the Original Exhibit "E".

Section 5 Acceptance Test/Inspection

The following will apply to the delivery of the FCS of lots Nos. 1, 2 and 3:

5.1.1 The seller will according to para. 6.2 of the Basic Agreement and as amended hereunder, carry out the Factory Acceptance Tests (FAT) on the FCS of lot No. 1 without the Block A and Block B software installed. Upon completion of said FAT, a Certificate of Acceptance, identifying the missing features of Block A and Block B software, shall be signed in accordance with Sub-Article 6.2.3 of the Basic Agreement.

5.1.2 The Seller will carry out the Factory Acceptance Tests (FAT) on the FCS of lots Nos. 2 and 3 without Block B installed. Upon completion of said FAT, a Certificate of Acceptance, identifying the missing features of Block B software, shall be signed in accordance with Sub-Article 6.2.3 of the Basic Agreement.

5.2 The Seller will carry out the Factory Acceptance Tests (FAT) on the FCR of lots Nos. 1 and 2, without the software supplement installed. Upon completion of said FAT a Certificate of Acceptance, identifying the missing features of the software, shall be signed in accordance with Sub-Article 6.2.3 of the Basic Agreement. These features will be added at the time set forth in the modified Exhibit "E" attached hereto as Annex "2" to this Amendment No. 2.

5.3 Upon the signature of the Certificate of Acceptance under Sub-Sections 5.1 and 5.2, as well as upon the signing of the Certificate of Acceptance for the other Subsystems/Units of Lots Nos. 1, 2 and 3, in accordance to the Basic Agreement, the FCS/FCR/other Subsystems/Unit will be deemed Delivered to Buyer in accordance with Sub-Article 6.2.6 of the Basic Agreement, provided however, that in the event of a termination by Buyer under Sub-Section 6.2 below, buyer will be entitled to retransfer title and return said FCS/FCR/other Subsystem/Unit to the Seller in accordance to the terms of said Sub-Section 6.3 below.

5.4 Seller shall perform the HAT and SAT on the first ship after the Delivery of both the Block A software and the FCR software supplement, in accordance with the procedures to be defined under Sub-Article 6.3.1 of the Basic Agreement. Upon the Delivery of the Block B software, Seller shall carry out on the first ship an integration and test in respect of the Block B software in accordance with procedures to be defined by Seller, in consultation with Buyer, specifically for this Block B software activity.

5.5 Upon the Delivery of the Block C software, Seller shall carry out on the first ship an integration and test in respect of the Block C software in accordance with to be defined Seller, in consultation with Buyer, specifically for this Block C software

activity.

5.6 Except as specifically set forth above, all provisions of Article 6 of the Basic Agreement shall remain unchanged.

Section 6 Delays.

6.1 The updated Exhibit "E" attached hereto as Annex "2" shall be the applicable Delivery/Program Schedule for all purpose of the Basic Agreement, including without limitations the provisions of Articles 3.2, 7, 8, 9, 10 and 14.

6.2 The last five lines of Sub-Article 7(i) and (ii) of the Basic Agreement shall be modified as follows:

"(i) For Lot No. 1 under Sub-Article 5.3, 60 days.

"(ii) For other lots under Sub-Article 5.3, 60 days.

up to a maximum of 6% of the price of any such delayed Subsystem/Unit."

6.3 Sub-Article 14.2.2 of the Basic Agreement shall be replaced with the following (it being understood that all reference in the following new 14.2.2 is to the provisions of the Basic Agreement, as amended under this Amendment No. 2):

"14.2.2 In the event that Seller fails to complete the Delivery of Block B software at the FAT of the Lot No. 4 FCS within 8 months after the grace period under Sub-Article 7(ii) for the performance of said FAT in accordance with Exhibit "E" (as such date shall be extended due to causes under Article 8), the Chilean Navy will be entitled to require ALPHA to submit an equitable solution to the delay. Should the Parties, after reasonable efforts, fail to reach mutual agreement on such an equitable solution, the Chilean Navy will be entitled to terminate part of all of the deliverables hereunder in accordance with Sub-Article 9.1, and will be entitled to return any previously delivered System/Subsystems/Units to Seller against a complete refund of any amount paid therefor as its sole remedy. Upon the successful completion of the FAT for the lot No. 4 with the Block B software installed therein, the provisions of this Sub-Article shall no longer apply and the Chilean Navy shall have no longer any right to return to ALPHA any of the previously delivered System /Subsystems/Units."

Section 7 Warranty

7.1 Delete Sub-Article 10.2.1 and replace the wording of Sub-Article 10.2.1.

"10.2.1 In respect of the second and third Systems (except missiles), such defect in material and workmanship is discovered within 18 month from completion of FAT of the last Subsystem of that particular System or 1 year after completion of the HAT, whichever comes earlier."

NOTE: In order to assure proper maintenance of the Subsystem that have completed their FAT in accordance with the schedule and prior to their shipment which shall be performed at the same time as the said last Subsystem of a particular System, the said Subsystem shall be retained after Delivery in Seller's premises and Seller shall be responsible for performing the maintenance activities at no additional cost to the Buyer.

7.2 The following shall be added as Sub-Article 10.2.5 :

"10.2.5 In respect of the first System, such defect in material and workmanship is discovered by the earlier of 12 months after the SAT on the ship containing said first System or December 19N6"

Section 8 Other terms of Basic Agreement and Amendment No. 1 to Basic Agreement.

Except as specifically set forth in this Amendment No. 2 to the Basic Agreement, all of the terms and provisions of the Basic Agreement and Amendment No. 1 to the Basic Agreement shall remain in full force and effect.

Section 9 Effective date of this Amendment.

This Amendment No. 2 will become effective on the last to occur of the following:

(i) the signature hereof by the Seller;

(ii) the signature hereof by Buyer; and

(iii) the signature by both parties of Amendment No. 1 to the Finance Agreement dated July 25, 19N0

IN WITNESS WHEREOF, Buyer and Seller have signed this Amendment No. 2 through their respective duly authorized representatives on the day and year first hereinabove written.

THE CHILEAN NAVY	OMEGA ALPHA AERONAUTICS
By: _____	By: _____
Name: _____	Name: _____
Title: _____	Title: _____

FINANCE AGREEMENT[33]

The Finance Agreement is made on the 25th of July of 19N0 between The Chilean Navy and ALPHA AERONAUTICS.

WITNESSETH

WHEREAS the Chilean Navy has purchased equipment and services from ALPHA, hereinafter referred as the "Seller"; and

WHEREAS, the Sales Agreement provides that payment by the Chilean Navy to the Seller shall be financed pursuant to a separate finance agreement; and

WHEREAS, the Parties desire to set forth the terms and conditions governing said financing;

NOW THEREFORE, the Parties hereto agree as follows:

ARTICLE 1 SCOPE OF AGREEMENT[34]

1.1 This Finance Agreement covers the financing of equipment and services purchased by the Chilean Navy to ALPHA Aeronautics under the Agreement signed on July 25, 19N0

ARTICLE 2 TOTAL CONSIDERATION UNDER THIS AGREEMENT

2.1 The total consideration for the Sales Agreement is US$ 103,106,000.

2.2 This Total Consideration excludes any amount for price adjustments under terms of the Sales Agreement.

2.3 The prices and terms of payment are set forth in the Sales Agreement.

---

[33] Names, dates and technical details are modified or omitted for security reasons. "ALPHA", "OMEGA" and other names related to the manufacturer are used instead of the real ones.

[34] This Agreement included other minor purchases. Paragraphs and information related to those purchases have been omitted.

2.4 The Total Consideration and the amounts due for price adjustment under the Sales Agreement shall be effected pursuant to the terms of the Finance Agreement, in particular Articles 3 and 4 below.

ARTICLE 3 INTEREST

3.1 In addition to the Total Consideration and the amounts due to Price Adjustments, the Chilean Navy will pay interest on the deferment of payments from the dates set for payment under the Sales Agreement to the dates of actual payment under this Finance Agreement.

3.2 The term of the Finance Agreement will be divided into consecutive 6 month periods, the first period beginning on the date of the last to occur of:

(i) Receipt by ALPHA of the US$ 7.1 million downpayment under Sub-Article 4.1 (1)

(ii) Receipt by ALPHA of the notes hereunder.

The Chilean Navy will pay interest to the Seller for each 6 month period during the term of this Finance Agreement at the 6 month US dollar LIBOR rate per annum as quoted in the MIDLAND BANK London, on the last banking day immediately preceding such period, plus a margin of 1.5% as specified in Annex "1" hereto.

ARTICLE 4 PAYMENT BY THE CHILEAN NAVY

4.1 The Chilean Navy will make the following payments on account of the equipment and services, price adjustments, and interest thereon:

(1) US$ 3.1 Millions within 30 days of the effective date of this Agreement.
(2) The following amounts will be due on the specified dates:

PAYMENT No.	AMOUNT (US$ Mill.)	DATE (M/D/Y)	No.	(US$ Mill.)	(M/D/Y)
2	6.0	3/31/N1	8	5.0	4/30/N5
3	10.0	3/31/N2	9	7.0	3/31/N6
4	12.0	3/31/N3	10	9.0	3/31/N7
5	10.0	3/31/N4	11	5.0	3/31/N8
6	5.0	4/30/N4	12	1.0	4/30/N8
7	7.0	3/31/N5	13	3.0	5/31/N8
			14	1.0	6/30/N8

PAYMENT No.	AMOUNT (US$ Mill.)	DATE (M/D/Y)
15	2.0	8/31/N8
16	3.0	9/30/N8
17	2.0	10/31/N8
18	5.0	3/30/N9
19	5.0	4/30/N9
20	3.0	3/31/N9
21	3.0	7/31/N9
22	3.5	8/31/N9
23	6.0	9/30/N9
24	5.0	10/31/N9
25	5.0	3/31/N10
26	DIFF*	5/30/N10
TOTAL :	126.6	(+/- DIFF)

* Pay total due or refund excess.

4.2 Promissory Notes

(a) The Chilean Navy shall, within 30 days of the Effective Date of this Agreement, deliver to ALPHA promissory notes (the "Notes") for each payment set forth in 4.1 (2), in accordance to the schedule of Notes listed in Annex "2" hereto.

Each said Note shall be payable to ALPHA or its order at OMEGA COMEX BANK, New York NY, U.S.A.

(b) The Notes shall be paid in lawful money of the United States of America and without set off or counterclaim, free and clear of and without deduction for any present or future taxes, assessments withholding, restrictions or conditions of any nature.

(c) The Chilean Navy shall be responsible to pay any fee or duty in connection with the issuance, delivery and payment of the Notes and shall duly stamp and register the Notes as required under the laws of the Republic of Chile.

(d) Should the Chilean Navy default in the payment of any of the Notes, all the remaining notes shall immediately become due and payable.

(e) The Chilean Navy hereby represents and warrants to each Note that:

(1) The Chilean Navy has full power, authority and legal right to execute, deliver and perform its obligations under the Note, and has taken all necessary legal actions required to authorize the execution, delivery and performance of the Note;

(2) The Note constitutes a legal, valid and binding of the Chilean Navy, enforceable in accordance with its terms, and is a fully negotiable instrument.

(3) The execution and delivery of the Note and the Chilean Navy's performance of its obligation under the Note does not violate any provision of any law or regulation binding upon it; and

(4) All permits and licenses required in connection with the execution, delivery and performance of the Note have been obtained and are in full effect.

(f) Any amount under this Finance Agreement unpaid on its due date shall bear interest from the due date until the actual date of payment at the 6 month US dollar LIBOR rate per annum, plus 3%, quoted by Midland Bank, London, at the beginning of each 6 month period commencing on the due date of the respective payment, compounded semi-annually.

(g) ALPHA undertakes not to sell to a third party any of the Notes listed in Annex "2" until the Delivery to the Chilean Navy of the last item of Lot No. 1 under Sub-Article 5.3.1 of the Sales Agreement, after which time ALPHA may sell to any third party those Notes whose payment date is prior to June 30, 19N8.

After the Delivery of the last item of Lot No. 2, ALPHA may sell to any third party those Notes whose payment date is prior to April 30, 19N9.

After the Delivery of the last item of Lot No. 3, ALPHA may sell to any third party those Notes whose payment date is prior to October 31, 19N9.

For the sake of clarity, notwithstanding the above, ALPHA may present the Notes, and the Chilean Navy shall pay same, upon their due date or any time thereafter.

(h) ALPHA agrees that, in regard to Notes still in their respective possession at any time, should the Chilean Navy desire to purchase any or all of said Notes, they will enter into good faith discussions with the Chilean Navy in an attempt to reach an agreement on such purchase by the Chilean Navy.

4.3 The payment of US$ 7.1 Million referred to it in Article 4.1(1) above will be made upon submission of a Guarantee/s issued by the Bank of Omega in the aggregate amount of US$ 7.1 million. The amount of the Guarantees shall be reduced in an amount equal to the value of the goods delivered by the Sellers under the Sales Agreement.

ARTICLE 5 FINAL ADJUSTMENT BETWEEN THE PARTIES

5.1 ALPHA will, at the end of each year, forward to the Chilean Navy a statement of the outstanding credit balance on account of the Total Consideration, interest and price adjustment calculated according to Annex "2" hereto.

5.2 Prior to May 19N10, ALPHA will submit to the Chilean Navy a calculation of the outstanding credit balance on account of the Total Consideration, price adjustment and interest, calculated according to Annex "2" hereto, showing any aggregate net excess or shortfall in Chilean navy payments which will occur by May 31, 19N10 as compared to the amounts listed in Sub-Article 4.1 above. In May 31 19N10 the Chilean Navy will pay said aggregate shortfall to ALPHA against an invoice presented by ALPHA. Any excess in favour of the Chilean Navy shall be refunded on May 31, 19N10.

Notwithstanding the above, the amount to be paid by the Chilean Navy shall not exceed US$ 43.5 million. Any additional amount due to ALPHA, together with interest thereon shall be paid on March 31 19N11.

5.3 Each Payment made by the Chilean Navy shall be applied in the following order:

(a) First, Interest accrued until the date of payment.

(b) Second, Total Consideration including price adjustment.

ARTICLE 6 ADMINISTRATION OF THIS AGREEMENT

6.1 ALPHA shall notify the Chilean Navy of any sale of Notes by ALPHA.

6.2 ALPHA agrees that prior to consumating the sale of Notes to a third party, it shall, upon the Chilean Navy's request, enter into discussion with the Chilean Navy for the sale of such Notes to the Chilean Navy, provided that the undertaking hereunder to refrain from consumating a sale shall only apply for a period of two weeks beginning upon the notice by ALPHA to the Chilean Navy of its intention to sell such Notes to a third party.

6.3 and 6.4 Omitted.

ARTICLE 7 DECRETO SUPREMO[35]

The Chilean Navy undertakes that the decreto Supremo that will bee issued shall meet the legal requirements necessary to make the Sales Agreement, this Finance Agreement, and the Notes effective and valid, shall be issued under the Reserved Laws Nos. 15.126 and 3.564 as established in the Decree Laws Nos. 1.235 (1979) and 2.456 (1984), shall authorize the name and title of the persons signing the above documents (including the Notes), and shall be signed by the President, Ministers of Defence and Finance of the Republic of Chile. Upon issuance of the Decreto Supremo, the Chilean Navy shall deliver copies of the same to ALPHA.

All the Notes will be issued in accordance with the present Agreement and the payment to be made will be effected in accordance with the Decreto Supremo.

ARTICLE 8 SETTLEMENT OF DISPUTES

8.1 The Parties shall endeavor to settle in a direct and friendly manner any difficulty, controversy, or lack of agreement which may arise in connection with this Agreement.

8.2 If such difficulties cannot be settled in said manner, they shall, at the request of either Party, be referred to arbitration in front of two arbitrators, one selected by ALPHA and the other by the Chilean Navy (Provided said individuals shall have necessary security clearance). If the two arbitrators fail to resolve an issue, they shall mutually agree upon a third arbitrator who will then resolve only in the unresolved issue. The arbitration will be administered in accordance with the Rules of Arbitration and Conciliation of the International Chamber of Commerce and will be held at a location agreed upon by the arbitrators (or if they do not agree, in Geneva, Switzerland). The arbitration will be held in the English language. The arbitrators' decision shall be final and binding on the Parties hereto.

8.3 In the event of doubt or disagreement with regard to the applicable law, the controversy shall be resolved in equity, the arbiter being bound only to the general principles of law recognized both by the legislation of country OMEGA as well as that of the Republic of Chile.

[35] Decree issued by the President.

ARTICLE 9 EFFECTIVE DATE

9.1 This Agreement shall enter into effect upon the occurrence of the last of the following two events, provided that both events occur no later than October 31, 19N0:

(a) Signature by both Parties of the Sales Agreement;

(b) Issuance of the signed Decreto Supremo authorizing the signature and funding of the Sales Agreement, this Finance Agreement and the Notes.

9.2 If the following two events do not occur within 30 days of the Effective Date of this Agreement (or such extended period granted by ALPHA in writing), then this Finance Agreement shall automatically terminate:

(a) Receipt by ALPHA of all the Notes provided for in Sub-Article 4.2 (a) above;

(b) Receipt by ALPHA of the US$ 7.1 million under 4.1(1) above.

ARTICLE 10 MISCELLANEOUS

10.1 Non-Waiver: The failure of either Party to insist in any or more instances upon strict performance of any of the terms of this Agreement or to exercise any rights conferred herein shall not be construed as a waiver or relinquishment to any extent of either Party's right to assert or rely upon any such term or right on any future occasion.

10.2 Captions: The title heading of the Articles hereof are intended solely for convenience of reference and are not intended and shall not be construed for any purpose whatever as in any way limiting or extending the language of the provisions to which the captions refer.

10.3 Notices and Correspondence :

(a) Any notice required to be given by either Party to the other hereunder shall be in writing and shall be delivered personally, or by registered or certified mail, or by facsimile or telex, to the other Party. Notice shall be deemed effected upon receipt of said written notification by the Party to whom the notice is sent, or, in the case of mail, within 15 days after the mailing of the same.

(b) All Notices shall be effected as follows :
(Addresses in Chile and Omega, omitted)

(c) All correspondence, information, specifications, reports, notices and any other written or oral communications between the Parties shall be in English or Spanish, preferably in English.

IN WITNESS HEREOF, the Parties hereto have signed this Finance Agreement one the date first hereinabove recited.

THE CHILEAN NAVY	OMEGA ALPHA AERONAUTICS
By: _____	By: _____
Name: _____	Name: _____
Title: _____	Title: _____

ANNEX 1

ADJUSTMENT

For the purpose of this Annex 2 the following denotation shall be used:

$t =$ The month index where 0 is the month of the Effective Date of this Agreement, 1 is one month after the Effective Date of this Agreement, and F the month of May 19N10.

$D_t =$ The amount payable on month t under the terms of payment of the Sales Agreement, including price adjustment.

$P_t =$ The amount actually paid in month t on account of the Total Consideration and price adjustments against presentation of Promissory Notes under the terms of this Finance Agreement.

$P_0 =$ The first payment under this Finance Agreement, in the amount of US$ 7.1 million.

$C_t =$ The outstanding credit balance on account of the Total Consideration and price adjustment in month t.

The formula for calculating C_t is:

$C_t = C_{t-1} + D_t - P_t$ for $t > 1$

$C_0 = D_0 - P_0$ for $t = 0$

Li = The annual interest rate to be applied on the outstanding credit balance. Li shall be the six-month LIBOR rate, as defined in Article 3.2 of this Agreement, plus a margin of 1.5% for outstanding monthly credit balances.

Nt = The amount actually paid in month t on account of interest, against presentation of Promissory Notes, under the terms of this Finance Agreement.

The formula for calculating Nt is:

$Nt = {}^{1}/_{12} \sum Ci\ Li$ for $i = j \rightarrow t-1$

where j is the month of the last payment.

APPLICATION OF PAYMENTS

Any amount actually paid in month t under the terms of this Financial Agreement will be divided into 2 parts, Pt and Nt, where any amount paid will be initially used to cancel accrued interest and only remaining balances will be applied against principal. If on any particular payment date the amount of interest due exceeds the total payment, the unpaid amount of interest will be capitalized and henceforth treated as an additional price adjustment.

FINAL ADJUSTMENT PAYMENT

The final Adjustment Payment to be made to ALPHA will be calculated as follows:

$$C_F - P_F$$

where the month-index F refers to the final month of this Finance Agreement, namely, May 19N10.

APPENDIX B. MODELS AND SCENARIOS USED TO EVALUATE THE RESULT OF THE PROCUREMENT

A. TACTICAL VALUE AND RISK MODEL

The purpose of this model is to evaluate the effects of changes in cost, schedule and performance in the value received by the buyer of a weapon system, and also to evaluate the outcome of the procurement after the fact.

This model looks at a weapon system as an investment that will cost some money to the buyer (the government) through its life cycle, which is usually referred to as Life Cycle Cost, and will give some value in return year after year, as the weapon system performs the task. The value depends mainly on two aspects:

- The capability of the weapon system, or its capacity to perform its missions.
- The risk of conflict, which makes the weapon system necessary.

If these two aspects are evaluated for the future years, the resultant is a curve of yearly value of the system.

Evaluating the tactical value of a weapon system or the risk of conflict in monetary terms is extremely complex. To overcome this difficulty, the model assumes that the negotiated conditions or the baseline set by the Project Manager reflects the fair value of the system. Then it looks at departures from the negotiated conditions and assess their impact based on that initially established "fair value".

1. Tactical Value

A system has a high initial tactical value when it is fielded. Then its tactical value decreases as countermeasures and more demanding threats are developed, until the weapon system becomes tactically obsolete. At that point, the system becomes a secondary or "backup" weapon system with a roughly constant low value. Finally, due to logistic obsolescence, the system is decommissioned. Upgrades or modifications to overcome tactical or logistic obsolescence might be considered from the beginning as cost of ownership if planned at that stage. Otherwise, they become a different project.

The result of this concept is a shape that describes the tactical value of a weapon system along its life cycle. That shape depends on the time it takes to reach tactical obsolescence, the decrease in tactical value beyond that point, and the time to decommission due to logistic obsolescence.

The typical shape of tactical valuethrough the life of the system is shown in figure B-1.

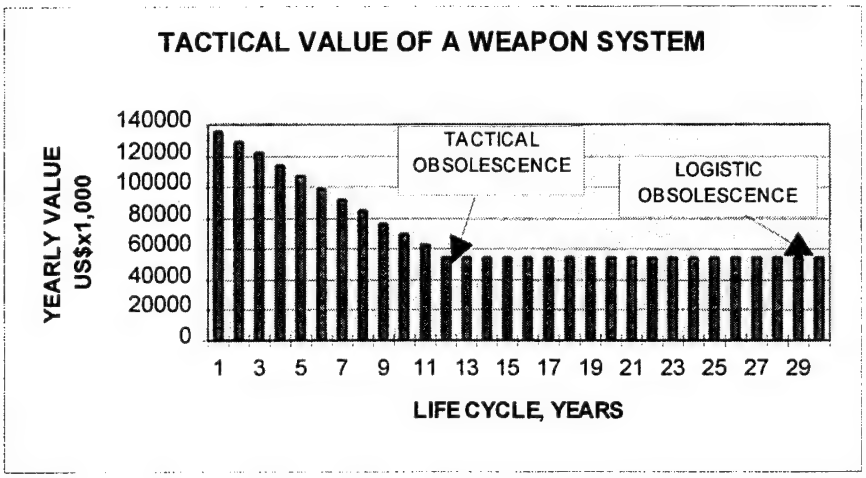


Figure B.1 Tactical Value Through the Life of the System

2. Risk Factor

Risk of conflict, and consequently the need for the weapon system is a function of the international strategic situation as related to the national interests and national security. Risk is a function of uncertainty about the future and the consequences of not having the system if required.

If there is not information about the potential cost of not having the system, uncertainty can be used as a measure. If we know that we do not face immediate risk of conflict, but we are not 100% certain of the future, we can assume that as time doubles, our certainty decreases to a certain rate, which is named here "Confidence level". If time is made very large, Rfn will tend to 1, meaning maximum risk. The expression for the risk factor "Rfn" as a function of the year "n" and confidence factor "C" is:

$$Rfn = 1 - n^{(-\log C / \log 2)} \qquad \text{(Eq B.1)}$$

Shapes of risk factors for different confidence levels are shown in figure B-2.

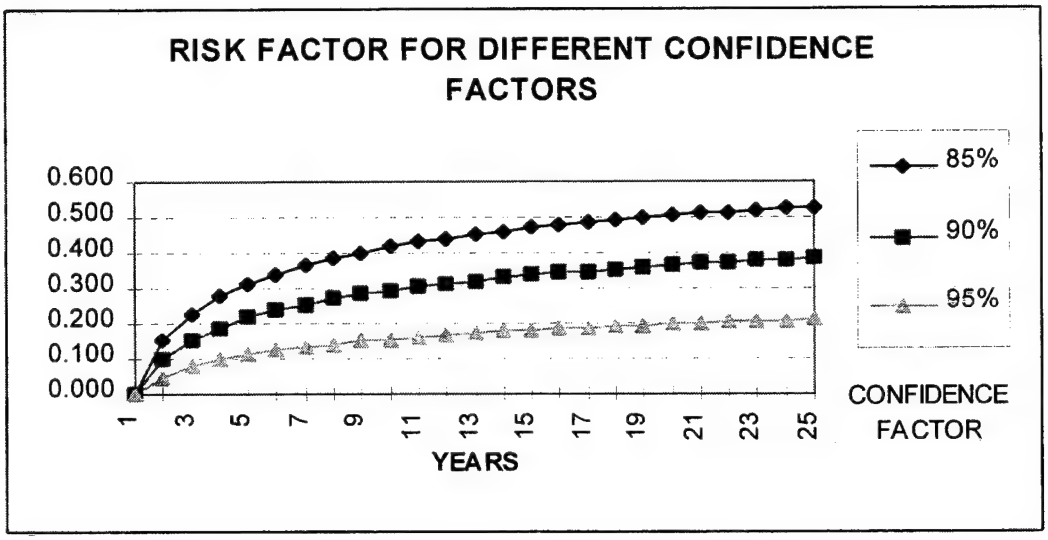


Figure B.2 Risk Factors for Different Confidence Levels

3. Evaluation

To compare the value of the system along its lifetime with the price paid for it, the value for different periods are converted in present value using a discount rate. That rate represents the opportunity cost of money for the government, which lays between the prevailing loan rates and the return of the most profitable forgone project, if profit can be measured.

To determine the shape of the Life Cycle Value of the System, the following variables shall be known or estimated:

P: Price, expressed as the present value of total payments

Q: Number of systems fielded.

Bg: Buyers gain: the difference between the value of the weapon system for the government and the price paid for it.

Tto: Time until the weapon system becomes tactically obsolete.

Tlo: Time until the system becomes logistically obsolete, so that it cannot be supported anymore at a reasonable cost.

Tvi: Tactical Value of the system on the schedule date of fielding.

Tvb: Tactical Value of the system beyond logistic obsolescence.

dr: Tactical value decrease rate, Tvi/Tvb.

Rfn: Risk factor for period "n"

k: Discount rate

Cn: Cost of ownership for period "n"

CO: Overall Cost of Ownership, present value of all Cn.

Vn: Value of the system for period "n"

Cd: Cost of disposal

Vs: Salvage value

The basic assumption of this model is that the negotiators were wise enough to settle for a price lower than the expected value of the system minus the ownership costs of it through its useful life. The Buyer's gain can be estimated according to the available options, the difference between the worst and best case scenario expected by the buyer, or valued in terms of cost of satisfying the same needs with other means. The following expressions put this assumption in a workable equation form:

Life Cycle Value = Life Cycle Cost + Bg (Eq B.2)

Life Cycle Cost = P + CO (Eq B.3)

Replacing Eq B.2 into B.1 and rearranging the terms:

Life Cycle Value = P + CO + Bg (Eq B.4)

4. Evaluation for Project Kilo

Based in the information available For Project Kilo, the following data will be used:

P: US$ 85,474,000 present value of payments according to the contract at a discount rate of 5.5%

Q: according to the delivery schedule and assumed Tlo

Bg: Determined as the diference between the worst and best case scenario. Zero gain is assumed for the worst case scenario.

Tto: 15 years, assumed according to experience with similar systems

Tlo: 25 years, assumed according to experience with similar systems

dr: 3 times, assumed

Rfn: according to a confidence level of 95%, based in the strategic scenario

k: 5.5%, typical rate of international loans as of the date of the contract

Cn: US$ 880,500 for year, based in cost of personnel and maintenance. This cost increases gradually until doubling at the end of the system's useful life. The determination of this value is shown in figure B.3.

CO: what results from Cn

Cd: not significant

Vs: not significant

All other variables are going to be determined from the model. The yearly weapon system values calculated with the given variables for a worst case represent the reference value. Further changes in schedule are introduced assigning values 0 to 3 to the variable Q (the number of systems), keeping the same yearly annual values for each system. Figure B.4 shows the sensitivity of the model to the most significant variables.

Personnel Costs

Salaries	7500
Benefits	3000
Other Pers. Costs	3000
Total:	**13500**

Personnel Requirements

6 crew members per ship
3 ships
25 people in logistic chain

Total Personnel	43
Unit Personnel Cost:	13500
Total Personnel Cost:	**580500**

Total Ownership Costs

Personnel	580500
Other ownership costs:	300000
Total:	**880500**

Figure B.3 Initial Annual Cost of Ownership of Kilo Missile System

EFFECTS OF	PRICE DECREASED 10%	11.11%
	DISCOUNT RATE DECREASED 1%	15.77%
	CONFIDENCE FACTOR DECREASED 1%	20.17%
	Tto REDUCED 2 YEARS	8%

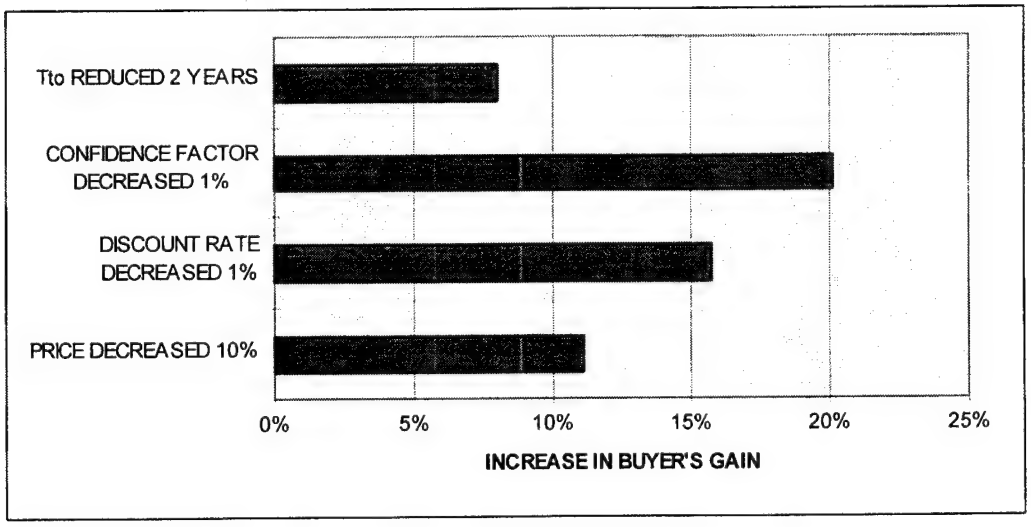


Figure B.4 Sensitivity Analysis of the Model

The following tables are used to calculate the value of the system being period "0" the date of the contract in the following order:

- Figure B.5 Summary of Expected Scenarios and Results
- Figure B.6 Worst Expected Scenario (Data and Graphs)
- Figure B.7 Best Expected Scenario (Data and Graphs)
- Figure B.8 Most Probable Expected Scenario (Data and Graphs)
- Figure B.9 Results of the Procurement (Data and Graphs)
- Figure B.10 What if the Contract Had Been Fulfilled (Data and Graphs)

Parameters common for all scenarios	
Time to Logistic Obsolescence:	25 years after fielding
Time to Tactical Obsolescence:	15 years
Initial Cost Of ownership:	US$ 880,500 per year
Final Cost of Ownership:	US$ 1761,000 per year
Discount Rate:	Libor + 1%
Confidence level (No Conflict	95%

	Libor rate	Delivery Delay	Present value of payments	Buyer's Gain	Remarks
Worst Acceptable Scenario	6.50%	4 years	US$ 75,435K	0.00%	
Most Probable Expected Sc.	4.50%	2 years	US$ 83,751K	41.03%	
Best Expected Scenario	4.50%	0 years	US$ 88,073K	52.62%	
Result of the Procurement	4.00%	4 years	US$ 79,265K	17.42%	Reduced Risk and Increased Tto
If Contract had Been Fulfilled	4.00%	0 years	US$ 88,073K	-19.98%	Reduced Risk

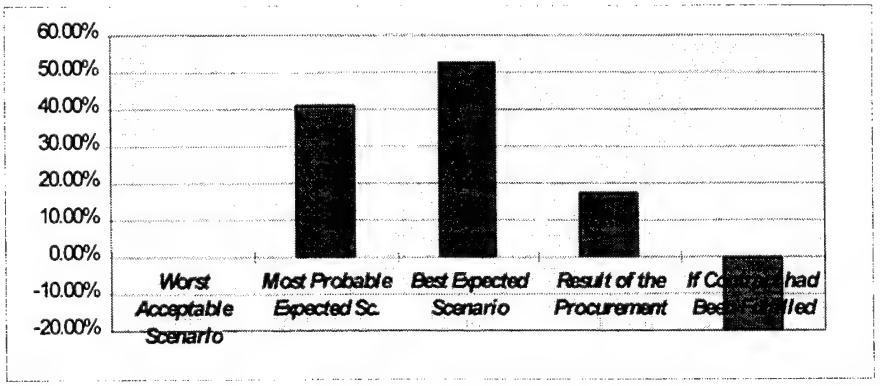
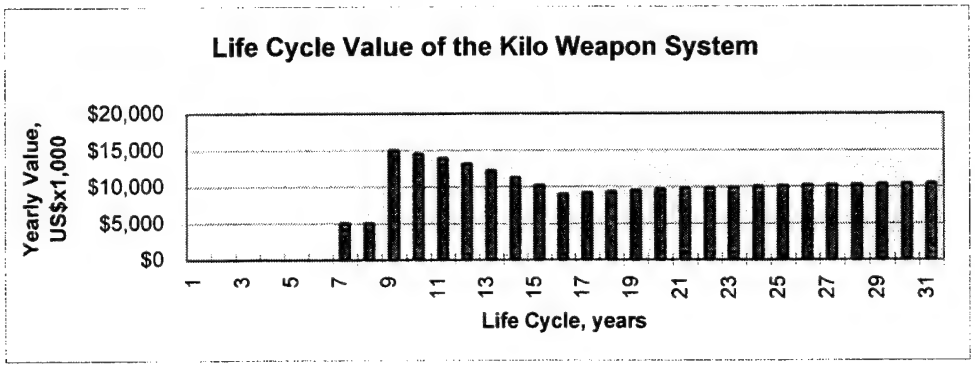


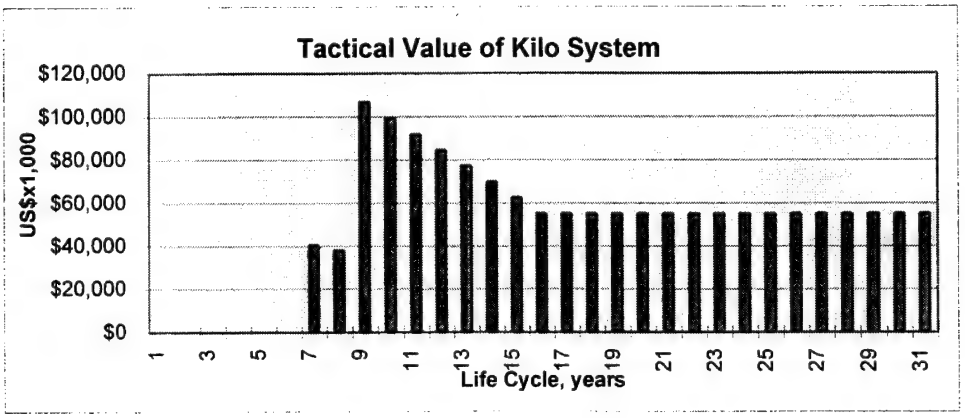
Figure B.5 Summary of Expected Scenarios and Results

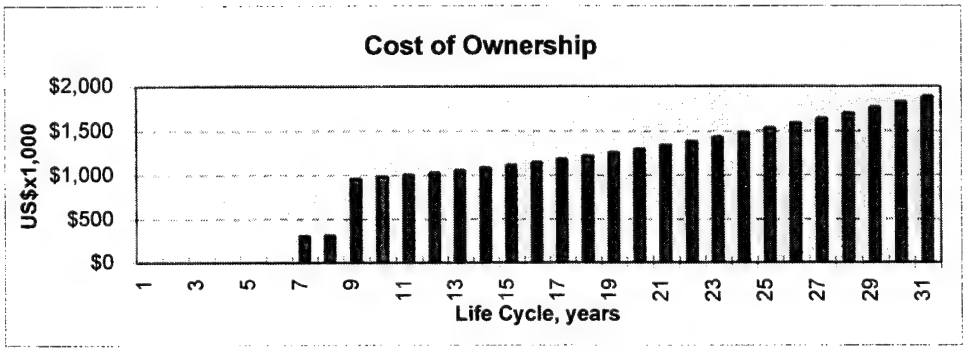
VALUES FOR THE THREE SYSTEMS	INPUT	OUTPUT
Tvb: Value beyond tactical obsolescence (US$x1,000)=		$55,232.59
Tto: Time to Tactical Obsolescence (years) =	15	
Tlo: Time to Logistic Obsolescence (years) =	25	
Initial Cn: Cost of Ownership (US$x1,000) =	$880.50	
P: Price, present value of payments =	$75,434.89	
Bg: Buyer's gain =	0.00%	
k: Discount rate =	7.50	
Delivery Delay (Years) =	4	
Life Cycle Value of the System, P+Bg		75,434.89
C: Confidence level	95%	

	Q	Rf	Cn	Tv	Vn	Period Net Value	
PERIOD		Values in US$ x 1,000					
0	0	0.000				($75,435)	Net Present
1	0	0.000	$0.00	$0	$0	$0	Value@k%
2	0	0.050	$0.00	$0	$0	$0	($0.00)
3	0	0.078	$0.00	$0	$0	$0	
4	0	0.098	$0.00	$0	$0	$0	
5	0	0.112	$0.00	$0	$0	$0	
6	0	0.124	$0.00	$0	$0	$0	
7	1	0.134	$310.60	$40,504	$5,432	$5,121	
8	1	0.143	$315.84	$38,049	$5,427	$5,111	
9	3	0.150	$965.30	$106,783	$16,024	$15,059	
10	3	0.157	$985.20	$99,419	$15,576	$14,590	
11	3	0.163	$1,007.18	$92,054	$14,967	$13,960	
12	3	0.168	$1,031.26	$84,690	$14,225	$13,194	
13	3	0.173	$1,057.44	$77,326	$13,368	$12,311	
14	3	0.177	$1,085.71	$69,961	$12,412	$11,326	
15	3	0.182	$1,116.07	$62,597	$11,367	$10,251	
16	3	0.185	$1,148.52	$55,233	$10,245	$9,097	
17	3	0.189	$1,183.07	$55,233	$10,447	$9,264	
18	3	0.193	$1,219.72	$55,233	$10,636	$9,416	
19	3	0.196	$1,258.46	$55,233	$10,814	$9,555	
20	3	0.199	$1,299.29	$55,233	$10,982	$9,683	
21	3	0.202	$1,342.21	$55,233	$11,142	$9,799	
22	3	0.204	$1,387.23	$55,233	$11,293	$9,906	
23	3	0.207	$1,434.35	$55,233	$11,437	$10,003	
24	3	0.210	$1,483.55	$55,233	$11,575	$10,092	
25	3	0.212	$1,534.85	$55,233	$11,707	$10,172	
26	3	0.214	$1,588.25	$55,233	$11,833	$10,245	
27	3	0.216	$1,643.74	$55,233	$11,954	$10,310	
28	3	0.219	$1,701.32	$55,233	$12,070	$10,369	
29	3	0.221	$1,761.00	$55,233	$12,182	$10,421	
30	3	0.223	$1,822.77	$55,233	$12,290	$10,467	
31	3	0.224	$1,886.64	$55,233	$12,394	$10,508	

Figure B.6 Worst Expected Scenario (Data)







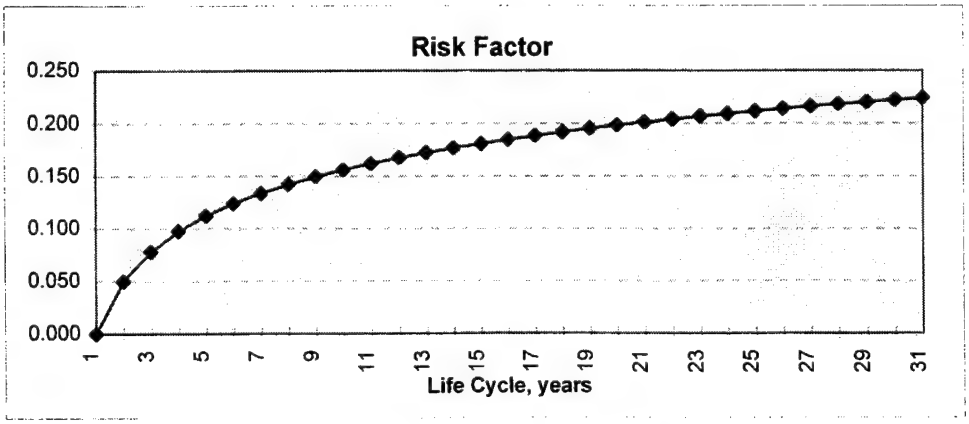
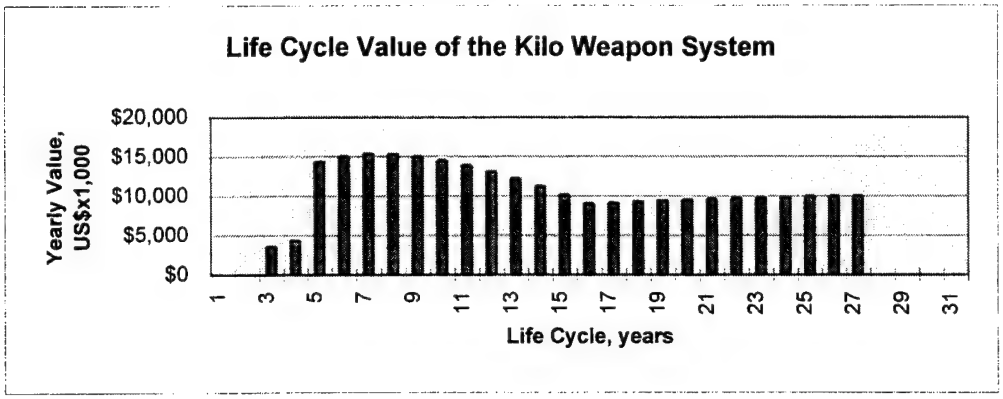


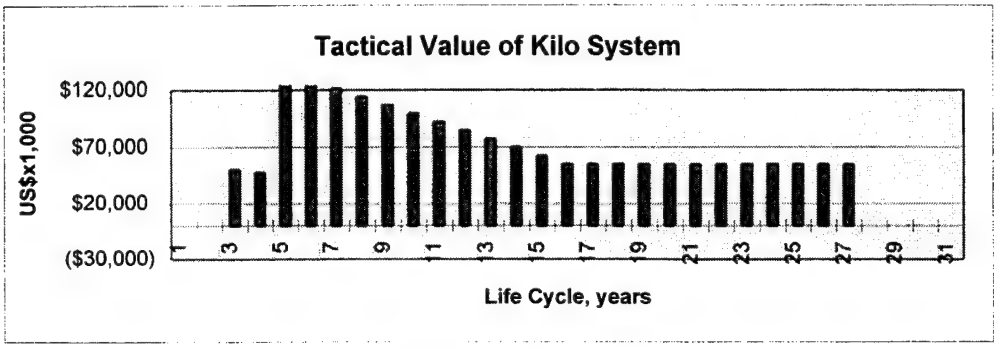
Figure B.6 Worst Expected Scenario (Graphs)

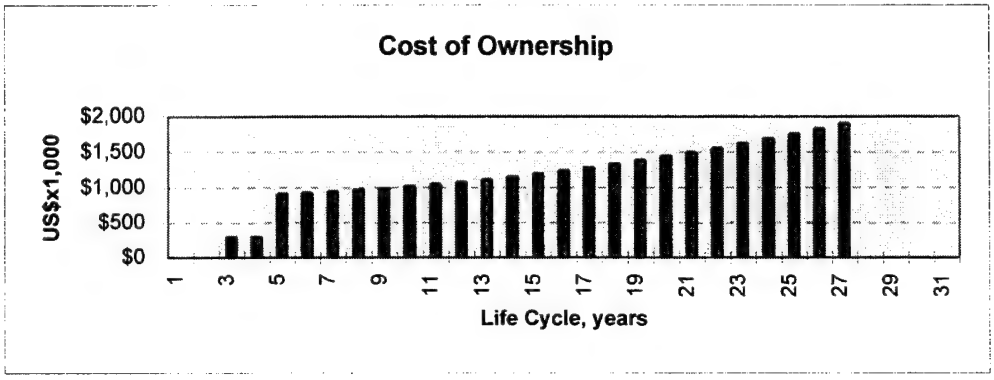
VALUES FOR THE THREE SYSTEMS	INPUT	OUTPUT
Tvb: Value beyond tactical obsolescence (US$x1,000)=	$55,232.59	
Tto: Time to Tactical Obsolescence (years) =	15	
Tlo: Time to Logistic Obsolescence (years) =	25	
Initial Cn: Cost of Ownership (US$x1,000) =	$880.50	
P: Price, present value of payments =	$88,072.92	
Bg: Buyer's gain =		52.62%
k: Discount rate =	5.50	
Delivery Delay (Years) =	0	
Life Cycle Value of the System, P+Bg		134,416.29
C: Confidence level	95%	

	Q	Rf	Cn	Tv	Vn	Period Net Value	Net Present Value@k%
PERIOD		Values in US$ x 1,000				($134,416)	($0.04)
0	0	0.000					
1	0	0.000	$0.00	$0	$0	$0	
2	0	0.050	$0.00	$0	$0	$0	
3	1	0.078	$297.73	$50,323	$3,929	$3,632	
4	1	0.098	$301.01	$47,868	$4,667	$4,366	
5	3	0.112	$915.72	$136,240	$15,297	$14,381	
6	3	0.124	$931.22	$128,876	$16,003	$15,072	
7	3	0.134	$949.53	$121,512	$16,296	$15,347	
8	3	0.143	$970.66	$114,147	$16,280	$15,310	
9	3	0.150	$994.61	$106,783	$16,024	$15,030	
10	3	0.157	$1,021.38	$99,419	$15,576	$14,554	
11	3	0.163	$1,050.96	$92,054	$14,967	$13,916	
12	3	0.168	$1,083.37	$84,690	$14,225	$13,142	
13	3	0.173	$1,118.59	$77,326	$13,368	$12,250	
14	3	0.177	$1,156.62	$69,961	$12,412	$11,255	
15	3	0.182	$1,197.48	$62,597	$11,367	$10,170	
16	3	0.185	$1,241.15	$55,233	$10,245	$9,004	
17	3	0.189	$1,287.64	$55,233	$10,447	$9,159	
18	3	0.193	$1,336.95	$55,233	$10,636	$9,299	
19	3	0.196	$1,389.08	$55,233	$10,814	$9,425	
20	3	0.199	$1,444.02	$55,233	$10,982	$9,538	
21	3	0.202	$1,501.78	$55,233	$11,142	$9,640	
22	3	0.204	$1,562.36	$55,233	$11,293	$9,731	
23	3	0.207	$1,625.76	$55,233	$11,437	$9,812	
24	3	0.210	$1,691.97	$55,233	$11,575	$9,883	
25	3	0.212	$1,761.00	$55,233	$11,707	$9,946	
26	3	0.214	$1,832.85	$55,233	$11,833	$10,000	
27	3	0.216	$1,907.52	$55,233	$11,954	$10,046	
28	0	0.219	$0.00	$0	$0	$0	
29	0	0.221	$0.00	$0	$0	$0	
30	0	0.223	$0.00	$0	$0	$0	
31	0	0.224	$0.00	$0	$0	$0	

Figure B.7 Best Expected Scenario (Data)







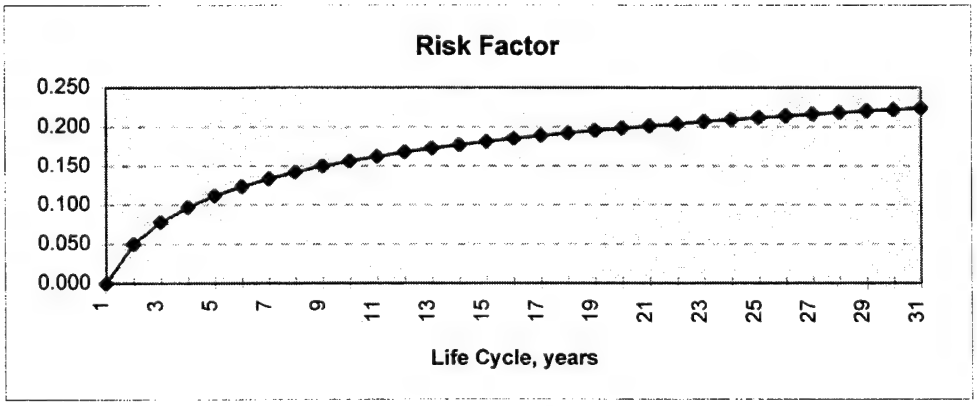


Figure B.7 Best Expected Scenario (Graphs)

VALUES FOR THE THREE SYSTEMS	INPUT	OUTPUT
Tvb: Value beyond tactical obsolescence (US$x1,000)=	$55,232.59	
Tto: Time to Tactical Obsolescence (years) =	15	
Tlo: Time to Logistic Obsolescence (years) =	25	
Initial Cn: Cost of Ownership (US$x1,000) =	$880.50	
P: Price, present value of payments =	$83,751.51	
Bg: Buyer's gain =		41.03%
k: Discount rate =	5.50	
Delivery Delay (Years) =	2	
Life Cycle Value of the System, P+Bg		118,112.14
C: Confidence level	95%	

	Q	Rf	Cn	Tv	Vn	Period Net	Net Present
PERIOD		Values in US$ x 1,000				Value	Value@k%
0	0	0.000				($118,112)	$0.00
1	0	0.000	$0.00	$0	$0	$0	
2	0	0.050	$0.00	$0	$0	$0	
3	0	0.078	$0.00	$0	$0	$0	
4	0	0.098	$0.00	$0	$0	$0	
5	1	0.112	$303.57	$45,413	$5,099	$4,795	
6	1	0.124	$307.99	$42,959	$5,334	$5,026	
7	3	0.134	$939.68	$121,512	$16,296	$15,356	
8	3	0.143	$957.80	$114,147	$16,280	$15,322	
9	3	0.150	$978.33	$106,783	$16,024	$15,046	
10	3	0.157	$1,001.28	$99,419	$15,576	$14,574	
11	3	0.163	$1,026.65	$92,054	$14,967	$13,941	
12	3	0.168	$1,054.43	$84,690	$14,225	$13,171	
13	3	0.173	$1,084.62	$77,326	$13,368	$12,284	
14	3	0.177	$1,117.23	$69,961	$12,412	$11,294	
15	3	0.182	$1,152.26	$62,597	$11,367	$10,215	
16	3	0.185	$1,189.70	$55,233	$10,245	$9,056	
17	3	0.189	$1,229.56	$55,233	$10,447	$9,217	
18	3	0.193	$1,271.83	$55,233	$10,636	$9,364	
19	3	0.196	$1,316.52	$55,233	$10,814	$9,497	
20	3	0.199	$1,363.63	$55,233	$10,982	$9,618	
21	3	0.202	$1,413.15	$55,233	$11,142	$9,728	
22	3	0.204	$1,465.08	$55,233	$11,293	$9,828	
23	3	0.207	$1,519.44	$55,233	$11,437	$9,918	
24	3	0.210	$1,576.20	$55,233	$11,575	$9,999	
25	3	0.212	$1,635.39	$55,233	$11,707	$10,071	
26	3	0.214	$1,696.99	$55,233	$11,833	$10,136	
27	3	0.216	$1,761.00	$55,233	$11,954	$10,193	
28	3	0.219	$1,827.43	$55,233	$12,070	$10,243	
29	3	0.221	$1,896.28	$55,233	$12,182	$10,286	
30	0	0.223	$0.00	$0	$0	$0	
31	0	0.224	$0.00	$0	$0	$0	

Figure B. 8 Most Probable Expected Scenario (Data)

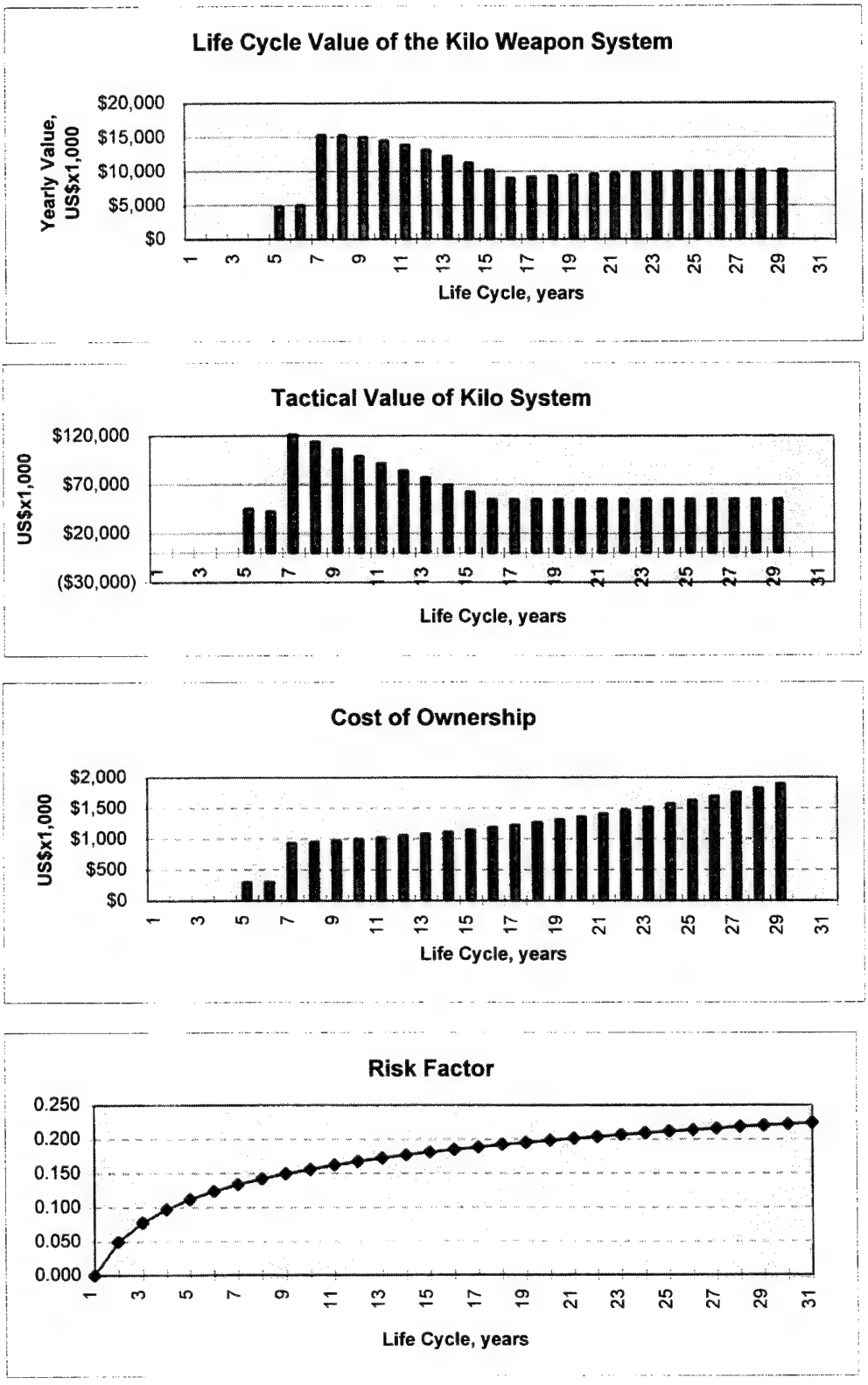
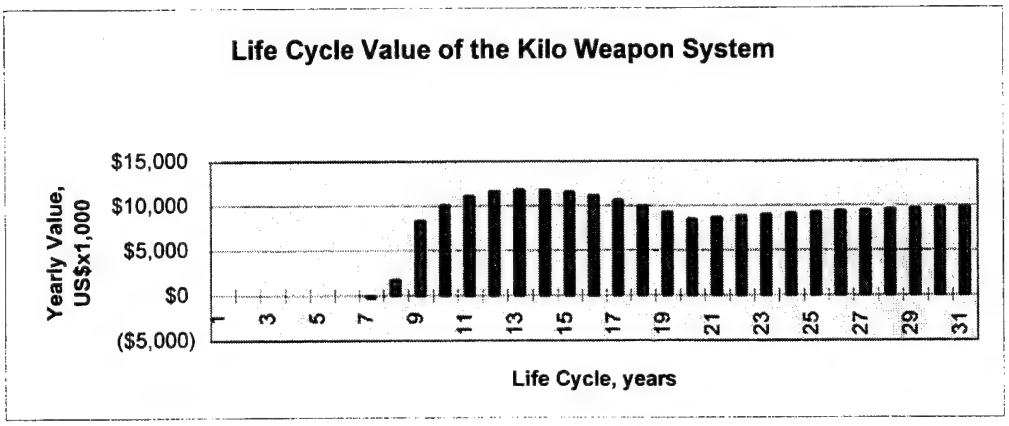


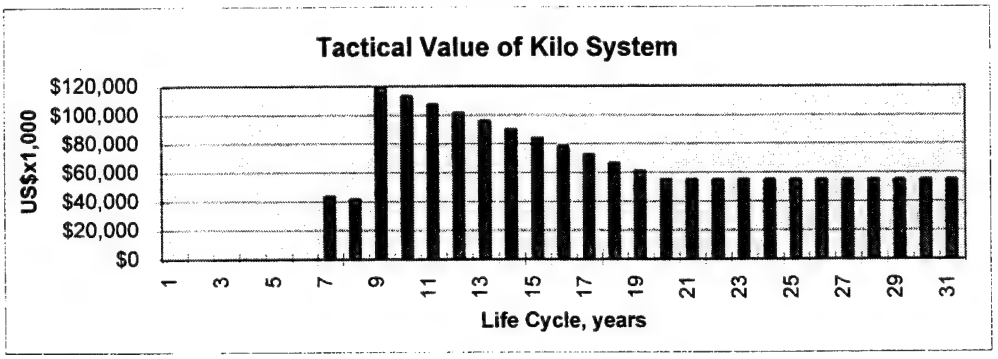
Figure B. 8 Most Probable Expected Scenario (Graphs)

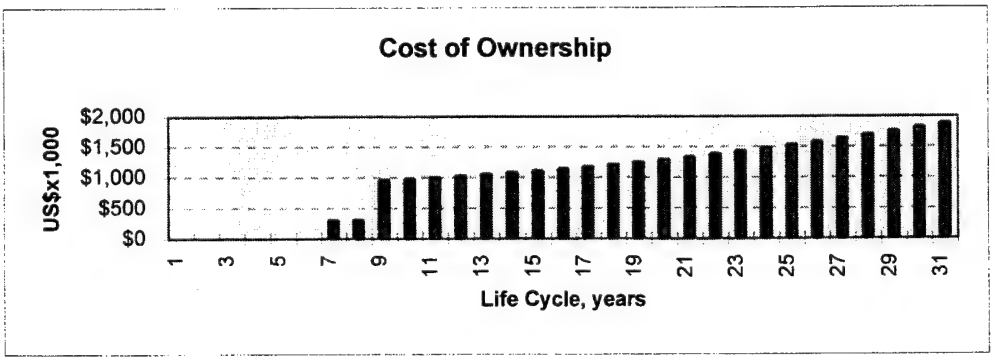
VALUES FOR THE THREE SYSTEMS	INPUT	OUTPUT
Tvb: Value beyond tactical obsolescence (US$x1,000)=	$55,232.59	
Tto: Time to Tactical Obsolescence (years) =	19	
Tlo: Time to Logistic Obsolescence (years) =	25	
Initial Cn: Cost of Ownership (US$x1,000) =	$880.50	
P: Price, present value of payments =	$79,265.63	
Bg: Buyer's gain =		17.42%
k: Discount rate =	5.00	
Delivery Delay (Years) =	4	
Life Cycle Value of the System, P+Bg		93,070.37
C: Confidence level	95%	

	Q	Rf	Cn	Tv	Vn	Period Net	Net Present
PERIOD		Values in US$ x 1,000				Value	Value@k%
0	0	0.000				($93,070)	$0.00
1	0	0.000	$0.00	$0	$0	$0	
2	0	0.000	$0.00	$0	$0	$0	
3	0	0.000	$0.00	$0	$0	$0	
4	0	0.000	$0.00	$0	$0	$0	
5	0	0.000	$0.00	$0	$0	$0	
6	0	0.000	$0.00	$0	$0	$0	
7	1	0.000	$310.60	$43,605	$0	($311)	
8	1	0.050	$315.84	$41,667	$2,083	$1,767	
9	3	0.078	$965.30	$119,186	$9,306	$8,341	
10	3	0.098	$985.20	$113,372	$11,054	$10,069	
11	3	0.112	$1,007.18	$107,558	$12,077	$11,069	
12	3	0.124	$1,031.26	$101,744	$12,634	$11,603	
13	3	0.134	$1,057.44	$95,930	$12,865	$11,808	
14	3	0.143	$1,085.71	$90,116	$12,853	$11,767	
15	3	0.150	$1,116.07	$84,302	$12,651	$11,535	
16	3	0.157	$1,148.52	$78,488	$12,296	$11,148	
17	3	0.163	$1,183.07	$72,674	$11,816	$10,633	
18	3	0.168	$1,219.72	$66,861	$11,230	$10,011	
19	3	0.173	$1,258.46	$61,047	$10,554	$9,295	
20	3	0.177	$1,299.29	$55,233	$9,799	$8,499	
21	3	0.182	$1,342.21	$55,233	$10,030	$8,688	
22	3	0.185	$1,387.23	$55,233	$10,245	$8,858	
23	3	0.189	$1,434.35	$55,233	$10,447	$9,012	
24	3	0.193	$1,483.55	$55,233	$10,636	$9,152	
25	3	0.196	$1,534.85	$55,233	$10,814	$9,279	
26	3	0.199	$1,588.25	$55,233	$10,982	$9,394	
27	3	0.202	$1,643.74	$55,233	$11,142	$9,498	
28	3	0.204	$1,701.32	$55,233	$11,293	$9,592	
29	3	0.207	$1,761.00	$55,233	$11,437	$9,676	
30	3	0.210	$1,822.77	$55,233	$11,575	$9,752	
31	3	0.212	$1,886.64	$55,233	$11,707	$9,820	

Figure B.9 Results of the Procurement (Data)







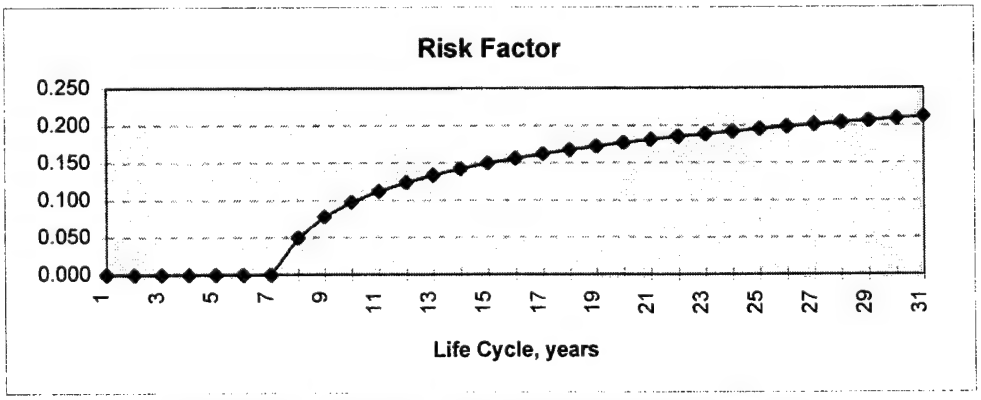


Figure B.9 Results of the Procurement (Graphs)

VALUES FOR THE THREE SYSTEMS	INPUT	OUTPUT
Tvb: Value beyond tactical obsolescence (US$x1,000)=	$55,232.59	
Tto: Time to Tactical Obsolescence (years) =	15	
Tlo: Time to Logistic Obsolescence (years) =	25	
Initial Cn: Cost of Ownership (US$x1,000) =	$880.50	
P: Price, present value of payments =	$88,072.92	
Bg: Buyer's gain =		-19.98%
k: Discount rate =	5.00	
Delivery Delay (Years) =	0	
Life Cycle Value of the System, P+Bg		70,480.16
C: Confidence level	95%	

	Q	Rf	Cn	Tv	Vn	Period Net	Net Present
PERIOD		Values in US$ x 1,000				Value	Value@k%
0	0	0.000				($70,480)	$0.00
1	0	0.000	$0.00	$0	$0	$0	
2	0	0.000	$0.00	$0	$0	$0	
3	1	0.000	$297.73	$50,323	$0	($298)	
4	1	0.000	$301.01	$47,868	$0	($301)	
5	3	0.000	$915.72	$136,240	$0	($916)	
6	3	0.000	$931.22	$128,876	$0	($931)	
7	3	0.000	$949.53	$121,512	$0	($950)	
8	3	0.050	$970.66	$114,147	$5,707	$4,737	
9	3	0.078	$994.61	$106,783	$8,338	$7,343	
10	3	0.098	$1,021.38	$99,419	$9,693	$8,672	
11	3	0.112	$1,050.96	$92,054	$10,336	$9,285	
12	3	0.124	$1,083.37	$84,690	$10,517	$9,433	
13	3	0.134	$1,118.59	$77,326	$10,370	$9,252	
14	3	0.143	$1,156.62	$69,961	$9,978	$8,822	
15	3	0.150	$1,197.48	$62,597	$9,394	$8,196	
16	3	0.157	$1,241.15	$55,233	$8,653	$7,412	
17	3	0.163	$1,287.64	$55,233	$8,980	$7,693	
18	3	0.168	$1,336.95	$55,233	$9,277	$7,940	
19	3	0.173	$1,389.08	$55,233	$9,549	$8,160	
20	3	0.177	$1,444.02	$55,233	$9,799	$8,355	
21	3	0.182	$1,501.78	$55,233	$10,030	$8,528	
22	3	0.185	$1,562.36	$55,233	$10,245	$8,683	
23	3	0.189	$1,625.76	$55,233	$10,447	$8,821	
24	3	0.193	$1,691.97	$55,233	$10,636	$8,944	
25	3	0.196	$1,761.00	$55,233	$10,814	$9,053	
26	3	0.199	$1,832.85	$55,233	$10,982	$9,149	
27	3	0.202	$1,907.52	$55,233	$11,142	$9,234	
28	0	0.204	$0.00	$0	$0	$0	
29	0	0.207	$0.00	$0	$0	$0	
30	0	0.210	$0.00	$0	$0	$0	
31	0	0.212	$0.00	$0	$0	$0	

Figure B.10 What If the Contract Had Been Fulfilled (Data)

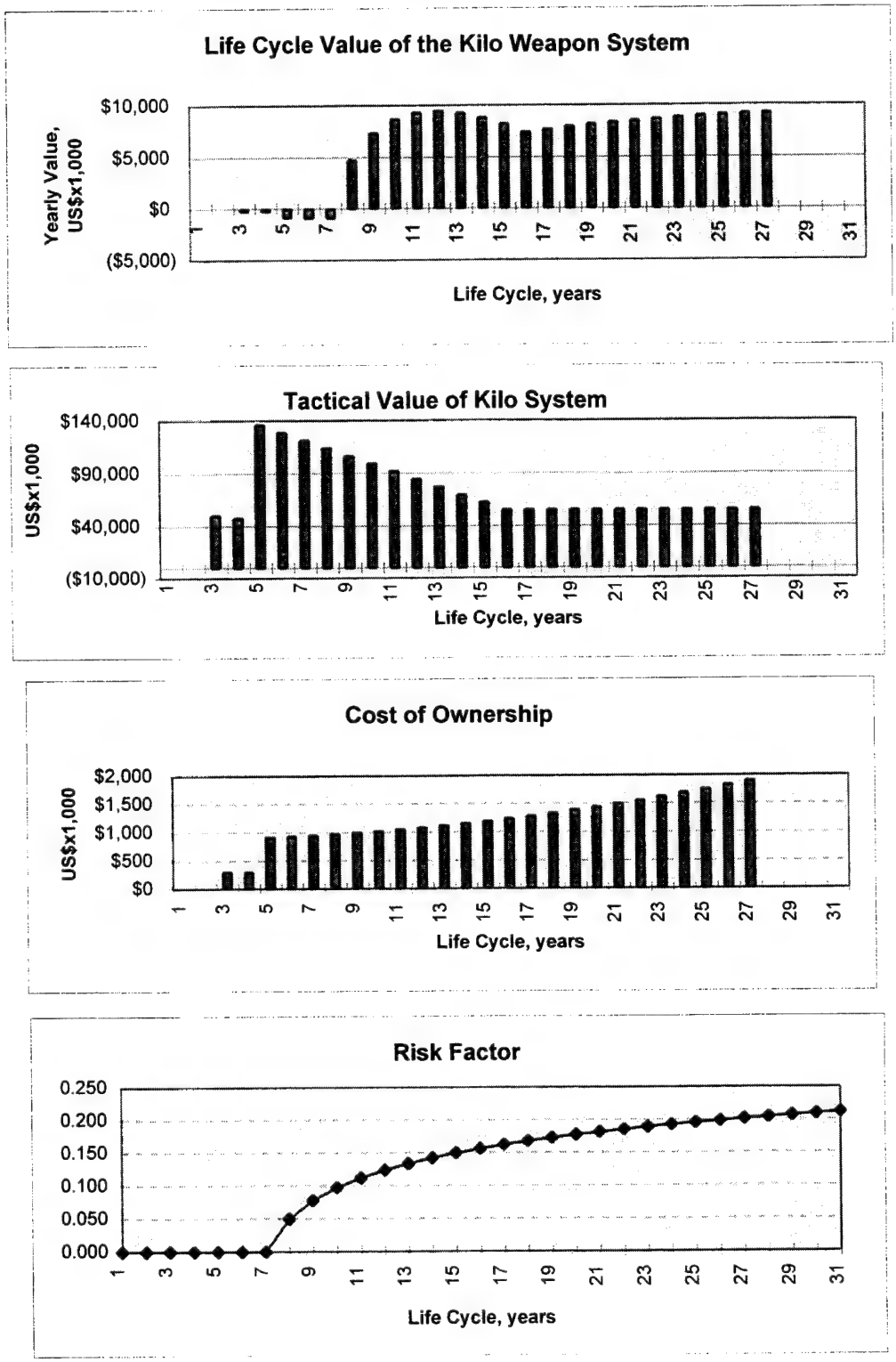


Figure B.10 What If the Contract Had Been Fulfilled (Graphs)

B. RISK AND DAMAGE REDUCTION MODEL

An alternative way of determining the value of a weapon system is to relate it to the defense strategy of the country, in terms of the contribution of the weapon system to reducing the risk of a conflict and its subsequent costs. Usually, nations determine the need to perform or impede certain operations (mission need), and then look for the most cost efficient way to accomplish that mission. The decision makers must ask themselves the following questions:

- What is the opportunity cost of being able to perform the mission?
- Is the cost of the system (material, personnel, and support) lower or at least equal to that opportunity cost?

Under a strategy of deterrence, weapon systems are purchased to minimize the risks involved in military conflicts. Those risks are related to the uncertainty about the probability of conflict, the consequences a conflict, the effect of the system to be procured in terms of reducing that risk of conflict, and the effect of the system in reducing the damage caused in a conflict. This model deals with all these uncertain variables, in an attempt to reach the value of a system across its life cycle. Finally, the yearly values are converted into net present value to determine what is the acceptable price of the system, with no relation to the cost of it.

All the variables that are going to be used in this model are expressed as a single unit: monetary value. Although it may seem inapropriate to do so, there is no other way to find how much is a weapon system worth. The model was not actually used in this thesis to calculate a specific value, but rather to illustrate the decision making process involved in procurement. Obtaining actual values from this model requires information and analysis well beyond the scope of this thesis.

1. Variables Involved

Risk of Conflict (R.C.) based on:

- Probability of Conflict P(c)
- Cost of a Conflict Cc
- Reduction in P(c) due to the system

Risk of Damage (R.D.) based on:

- Probability of Damage P(d)
- Cost of Damage Cd
- Reduction in P(d) due to the system

Components of Cost of Damage (Cd) are:

- Human life losses Cdl
- Material losses Cdm
- Strategic Losses Cds
- Strategic Gains Gds

2. Evaluation of the Variables

(a) Risk of Conflict (R.C.) Risk is a function of the probability of an adverse event and the impact of that event. Risks differs with uncertainty in two ways: First, it deals only with the negative side of a probability distribution, and second, it takes into account the cost or impact of an uncertain event. In this particular case, Risk is expressed as the potential cost associated to a conflict, and the probability of such conflict in the future years.

(b) Probability of Conflict (P(c)). This variable is a function of time, is probabilistic, and should be determined by intelligence specialists. During periods of low tension, it is fair to assume that the probability depends on the long term trends of the international relations. It is also generally safe to assume that uncertainty tends to increase with time.

(c) Cost of Conflict (Cc). The cost of a conflict is the result of the loss of lives, loss or gain of strategically valuable territory, use of economic resources, loss of business opportunitties, and all other potential consequences of a military conflict. It must be considered, however, that a conflict can have positive outcomes also, that should be deducted from the costs. Those outcomes are related to strategic achievements and the historic impact of military victories. Those potential positive outcomes are usually the motivation for war, and they must be reduced as much as possible for potential adversaries.

Another important aspect in this variable is that war is not a zero-sum game. Usually the overall losses of the parties are much greater than the achievements. Thus, a loss caused to the enemy is not necessarily a gain for us. Given the complexity of this variable, it is not wise to attempt a subdivision at this point between components of cost.

(d) Reduction in P(c) Due to the System. This variable relates to the very purpose of procurement under a deterrence strategy. Each system contributes to neutralize strengths of potential adversaries, thus reducing the benefits of initiating a conflict. This has to do with the perceived effectiveness of the system, and the importance of the strength being neutralized in the adversary's strategy. This variable is also probabilistic and variable across time. Systems tend to have a high impact when they are fielded which decreases with time as countermeasures and new strengths are developed.

(e) Risk of Damage (R.D.). Analogue to Risk of Conflict, Risk of Damage is the combination of the probability of damage caused by the system or to our side by the enemy, and the impact of that damage.

(f) Probability of Damage (P(d)). If deterrence fails and conflict happens, the interaction between the parties will cause damage. The probability of suffering damage or causing damage to the enemy given a conflict is evaluated in terms of probability. This must be done by intelligence, tactical and engineering experts, through wargaming and other simulation techniques. At this stage, only the damage caused or avoided by the weapon system under analysis is relevant. By definition, P(d) is a conditional probability, since it will only exist if a conflict occurs.

(g) Reduction in P(d) Due to the System. The purpose of a weapon system is to maximize damage caused to the enemy and/or minimize damage caused to us by the enemy. The effectiveness of the weapon system can be evaluated as the probability to produce and/or avoid damage with the system. The model to use will depend on th type of weapon, either defensive, offensive or both.

(h) Cost of Damage (Cd). If damage occurs, its consequences are to be assessed in terms of human, material and value independent of its probability. Those losses will be also probabilistic in nature, since the same successful attack can have widely different consequences. When assessing the cost of damages caused to the enemy, only the strategic

component is relevant for the purpose of our calculations, since the material and human losses will be of no benefit for us. It can even be beneficial to avoid human and long term material losses on the enemy's side, which is part of the strategic impact evaluation.

(1) Human Life Losses (Cdl). Although it may sound cruel to put a "price tag" on human lives, it is a necessary and usual practice. Insurance companies, safety agencies and health specialists deal with this challenge everyday. In the case of the military, loss of lives has costs related with the replacement of the dead and injured, the sycological impact over the rest of the fighters, and the logistic impact of evacuating and treating the injured. There is also an effect over the necessary personnel to accomplish the missions required by the effort of the conflict, but that is part of the strategic losses, and shall not be accounted for in this category. Above all the previous components, lives lost have an impact over the families and the society at large.

(2) Material Losses (Cdm). A successful attack will damage military equipment, reducing its effectiveness or rendering it useless. It might also damage civilian equipment or installations. The probable material cost of a successful attack should be estimated as a probabilistic value.

(3) Strategic Losses (Cds). Probably the most complex part of determining the cost of a successful impact is determining the strategic effect in terms of the impact of the attack in the achievement of the strategic goals. That impact is related to the reduction of military power and commitment due to damages and the efforts drained from the core missions to cope with the damages and its consequences. It is evaluated in terms of the expected cost of not achieving the strategic goals given a succesful attack. Only expert estimation and wargaming can provide an insight about this variable.

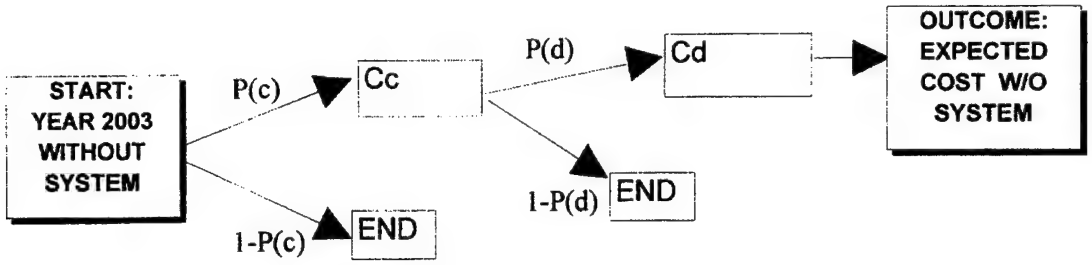
(4) Strategic Gains (Gds). The damages inflicted on the enemy will benefit our strategy. That benefit should be subtracted from the losses mentioned in the previous point.

3. The Model

This model is a comparative risk analysis in a situation with uncertain variables and conditional probabilities. It goal is to evaluate the value of a weapon system for each future

period in terms of the expected cost of not having the system. The following probability trees in figure B.11 show the interaction of the variables for a particular period:

WITHOUT THE SYSTEM



WITH THE SYSTEM

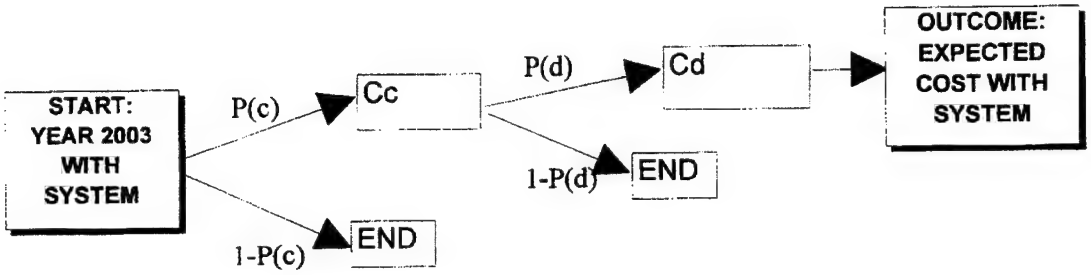


Figure B.11 Probability Trees for Risk and Damage Reduction Model

The outcome is determined as:

Expected Cost = P(c) X Cc + P(c) X P(d) X Cd

Expected Value of the System = Exp. Cost Without the System - Exp. Cost with the System

Notice that the variables have not discrete values, but actually probability distributions, so the outcome can be found through simulation. As an example, the following table shows values for simulation using a Beta distribution.

An important remark also is that the probability distributions of the different variables must be determined independently for the two scenarios, with and without the system, as shown in figure B.12. This is important since the behavior and strategies of our country and that of the potential adversaries will be different in the two cases.

WITHOUT SYSTEM

		Optimistic	Most Likely	Pessimistic	Predicted
	P(c)	0.00%	1.50%	4.00%	3.00%
	Cc	$0.00	$3,000.00	$25,000.00	$10,000.00
	P(d)	0.00%	10.50%	45.00%	2.50%
Cd	Cdl	$0.00	$15.00	$85.00	$20.00
	Cdm	$2.00	$25.00	$150.00	$85.00
	Cds	$0.00	$20.00	$300.00	$100.00
	Gds	($100.00)	($20.00)	$0.00	($35.00)
	EXPECTED COST US$ Millions :				$300.15

WITH SYSTEM

		Optimistic	Most Likely	Pessimistic	Predicted
	P(c)	0.00%	1.30%	3.50%	2.50%
	Cc	$0.00	$3,000.00	$25,000.00	$10,000.00
	P(d)	0.00%	6.50%	25.00%	1.50%
Cd	Cdl	$0.00	$15.00	$85.00	$20.00
	Cdm	$2.00	$25.00	$150.00	$85.00
	Cds	$0.00	$20.00	$300.00	$100.00
	Gds	($100.00)	($20.00)	$0.00	($35.00)
	EXPECTED COST (US$ Millions) :				$250.06

EXPECTED VALUE OF THE SYSTEM FOR YEAR 2003 (US$ MIllions) :	$50.09

P(c) Probability of Conflict
Cc Cost of Conflict

P(d) Probability of Damage given a Conflict

Cd Cost of Damage
Components of Cost:
Cdl Cost of Human Lives and Injuries
Cdm Cost of Material and Resources
Cds Strategic Cost
Gds Strategic Gain

Using simulation, this exercise can be repeated enough times to obtain the probability distribution for the value of the sytem.

Figure B.12 Example of Calculation of System Value

C. CASH FLOW SCENARIOS

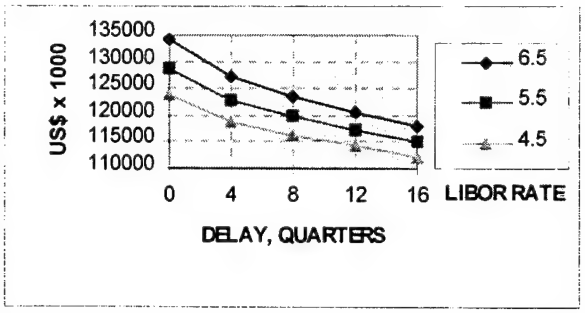
This section shows the cash flows as determined by delivery schedule of the contract and the possible variations in interest rate and delays. Figure B.13 summarizes the delivery schedule and predicted cash flows. Figure B.14 shows how changes in interest rates and delivery delays affect the projected payments.

QUARTER		PAYMENT DUE, US$ x 1000										DUE		PAYMENT		DIFF
AFTER EDC	60%	LOT #	DELIVERY	LOT #	DELIVERY	LOT #	DELIVERY	LOT #	DELIVERY	LOT #	DELIVERY	QUARTER	ACUM	AGREED	ACUM	
0	5155.30											**5155.30**	5155.30	3100	3100	**2055.30**
1												**0.00**	5155.30	0	3100	**2055.30**
2												**0.00**	5155.30	0	3100	**2055.30**
3												**0.00**	5155.30	0	3100	**2055.30**
4	9279.54											**9279.54**	14434.84	0	3100	**11334.84**
5												**0.00**	14434.84	6000	9100	**5334.84**
6												**0.00**	14434.84	0	9100	**5334.84**
7												**0.00**	14434.84	0	9100	**5334.84**
8	21652.26											**21652.26**	36087.10	0	9100	**26987.10**
9												**0.00**	36087.10	10000	19100	**16987.10**
10	18559.08											**18559.08**	54646.18	0	19100	**35546.18**
11		26	210.00									**210.00**	54856.18	0	19100	**35756.18**
12	7217.42	1	8045.40	24	424.20							**15687.02**	70543.20	0	19100	**51443.20**
13												**0.00**	70543.20	12000	31100	**39443.20**
14												**0.00**	70543.20	0	31100	**39443.20**
15		2	8045.40									**8045.40**	78588.60	0	31100	**47488.60**
16		8	30.00									**30.00**	78618.60	0	31100	**47518.60**
17		11	1069.20			27	70.00					**1139.20**	79757.80	0	31100	**48657.80**
18				12>19	336.60	1	2639.60	1	42.20			**3018.40**	82776.20	10000	41100	**41676.20**
19		3	8045.40	4	1036.80	9	30.00					**9112.20**	91888.40	5000	46100	**45788.40**
20				22	356.40							**356.40**	92244.80	0	46100	**46144.80**
21				12>19	112.20	25	141.40					**253.60**	92498.40	7000	53100	**39398.40**
22		5	2073.60	2>3	5279.20	2>3	84.40	10	30.00	9>10	30.00	**7497.20**	99995.60	5000	58100	**41895.60**
23												**0.00**	99995.60	0	58100	**41895.60**
24												**0.00**	99995.60	0	58100	**41895.60**
25												**0.00**	99995.60	7000	65100	**34895.60**
26												**0.00**	99995.60	0	65100	**34895.60**
27												**0.00**	99995.60	0	65100	**34895.60**
28		6	1036.80									**1036.80**	101032.40	0	65100	**35932.40**
29												**0.00**	101032.40	9000	74100	**26932.40**
30		7	2073.60									**2073.60**	103106.00	0	74100	**29006.00**
31												**0.00**	103106.00	0	74100	**29006.00**
32												**0.00**	103106.00	0	74100	**29006.00**
33												**0.00**	103106.00	5000	79100	**24006.00**
34												**0.00**	103106.00	5000	84100	**19006.00**
35												**0.00**	103106.00	5000	89100	**14006.00**
36												**0.00**	103106.00	2000	91100	**12006.00**
37												**0.00**	103106.00	5000	96100	**7006.00**
38												**0.00**	103106.00	8000	104100	**-994.00**
39												**0.00**	103106.00	12500	116600	**-13494.00**
40												**0.00**	103106.00	5000	121600	**-18494.00**
41	**61863.60**											**0.00**	103106.00	5000	126600	**-23494.00**

Figure B.13 Projected Delivery, Cash Flow and Payments Due

TOTAL PAYMENTS, US$ x 1000

DELAY QUARTERS	LIBOR RATE, %		
	6.5	5.5	4.5
0	134,151	128,797	123,975
4	127,302	122,816	118,787
8	123,774	119,884	116,381
12	120,629	117,281	114,251
16	117955	114991	112317



Net Present Value @ Libor + 1%

DELAY QUARTERS	LIBOR RATE, %		
	6.5	5.5	4.5
0	82,978	85,474	88,073
4	79,897	82,452	85,128
8	78,286	80,949	83,752
12	76,801	79,550	82,461
16	75,435	78,250	81,249

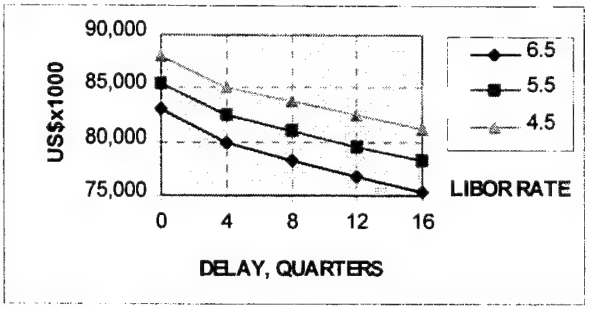


Figure B.14 Impact of Delay and Interest Rates on Total Payments

APPENDIX C: INTERVIEWS

A. OVERVIEW

Interviews are among the most important information sources for this thesis. All the sequence of events of the Project Kilo case, and the reasons behind those events were collected from interviews. The understanding of Private business practices was also obtained from interviews to real world business managers. This appendix shows the relevant portions of those interviews.

B. INTERVIEWS WITH ACTORS ON THE CASE

The following three interviews were the basis to understand the issues of the case, being a strong complement to the contract itself and previous reports. The interviews were conducted in Spanish and translated by the author.

1. Rear Admiral AAA[36]

Admiral AAA was an O5 when he was appointed as Project Manager for the materialization of a recommendation of the Fleet Repowering Study. An Electronic Engineer, with a Master degree from a prestigious institute in the U.S.A. and an outstanding career on the fleet, Commander AAA was the right person for the job. He led all the procurement process, from the source selection to the signature of the contract, and had all the responsibility for that contract.

In this interview, he explained the position of the Chilean Navy and himself during the source selection and contract negotiation process.

The following is an extract from a telephone interview conducted on October 2, 1995.

- Admiral, what was your position during the negotiation process, and what percentage of your time was devoted to this project?

I was the Operations Officer at the Weapons Directory, and I had Project Kilo as a part time assignment. However, it soon took hundred percent of my time, as it became more complex and important. All my tasks at the Weapons Directory were delegated to other

---

[36] Names have been omitted to protect classified information.

officers.

- What legal, financial, business, language or other support did you receive, and from whom?

Legal support was provided by Captain LLL, the lawyer for the General Logistics Directory, and was pretty helpful. However, he had many other commitments, so I could not count on him all the time. Limited financial advise was provided by a consultant when the interest rates and the price adjustment formulas were being discussed. All the rest was handled by the project team, consisting only in Commander GGG and me.

- Was the help from non-Navy experts considered for the negotiation team?

No, it was not possible because of the high classification of the project. As mentioned before, advice was considered for specific matters, without giving access to classified information to outsiders.

- Which was the hardest point to negotiate?

The financial aspects were the more complex, because we were forced to get financial support from them, and the financial agreement involved several other procurements besides the Kilo system. We had very little room for maneuver, and we could not put stringent demands on them. Flexibility was limited also, in the sense that any change for project Kilo would involve the other procurements as well.

- Was a "worst case scenario" considered in terms of cost, schedule or performance?

No, the negotiations were approached as fixed price, and we expected variations only from interest rates or price adjustments. In terms of schedule, we did not have a formal appreciation about how much could the deliveries be delayed, but we had the feeling that the promised three years to have the first system fielded were ambitious for the degree of matureness of the system. We would not be surprised with a year or two of delay. With respect to performance, we were pretty impressed by the performance obtained by the prototype tested by ALPHA. We were confident in the capabilities of ALPHA, and we did not consider a scenario of failure. If difficulties were to be solved, it would be a matter of some extra time.

- Did you have information about past performance of ALPHA?

We have been informed by the Air force that they had performed well with them before. Their reputation with previous system was solid, but we also had been told that they were not easy in negotiations.

- Was there a contingency plan in case of failure of ALPHA to deliver?

Actually not, as I said before, we were confident about them and we did not thought about that possibility. However, a termination clause was included to put pressure on them in case of excessive delays. In our selection process we had discarded other systems that cost much more than ALPHA's one, and being more mature were also getting obsolete, unless they introduced major changes. We knew that we had no choice other than ALPHA.

- The contract refers to standards of Omega's Navy. Did you have access to those standards?

That was a generic statement. We had no access to Omega's Navy, and they were completely loyal to ALPHA. Omega's Navy had not signed yet the contract for the Kilo system. We had though some personal contacts among Navy officers that were very helpful, but they were not going to put pressure on ALPHA on our behalf.

- The contract included a Force Majeure clause, relieving ALPHA from responsibilities under "acts of government". Considering that ALPHA was owned by the government, was such clause considered legitimate?

We were concerned about it, but the lawyer studied it and concluded that it was normal practice in such circumstances, and that the clause could not be abused by ALPHA.

- The contract warranty covered materials and workmanship. What would happen in case of a failure due to design problems?

The specifications were written in terms of performance. If any subsystem failed to perform in the tests, it would have been a non-compliance situation rather than a warranty issue. We could reject the system and request ALPHA to fix it.

- According to the contract ALPHA was obliged to provide spare parts at a reasonable price for ten years. How was the reasonableness assessed? Was there an alternative provider?

Kilo system was different from anything else in the marketplace. Spare parts were going to be needed, and the only reference we could have were prices offered to Omega's Navy, if we could get access to them.

- The amendment number 3 of the contract refers to software among other issues. Did you have the knowledge and the necessary access to the software development and documentation? Were there areas where you lacked the necessary expertise?

Software was one of our strong sides. We arrange with ALPHA to use a language accessible to us and known internationally. We even provided parts of the software, developed by my assistant project manager. He also detected a shortage in thrust in the original engine according to the trajectory requirements, and worked with ALPHA in correcting that shortage. I think that we were strong enough in the technical side.

- How was their negotiation capacity compared to the project team?

They were very skillful and tough negotiators. Their lawyers had a complete knowledge of the processes at ALPHA, so they could handle any demand knowing its effect in the legal, financial and production side. They also hired an attorney from new York, because New York State law would be applicable to the contract.

- If you had the chance to start the process again, what would you improve?

First, I would define better the final product. I had also got rid of the ties with other procurements, to get more freedom of action to handle this one. Finally, I had consider what-if kind of analyses for the case of extreme delays or other unexpected events.

To cope with that kind of situation I would have provided more flexibility to the contract, avoiding the need for renegotiation.

- Do you think that having more people in your team would have helped?

I don't think it wold have been relevant. We were strong enough in the technical side. Our weaknesses were a related to the lack of financial independence.

- What other experience do you think is interesting to mention?

An important experience was the use of competition. We were able to obtain a lot of information and to drive prices down significantly while we kept three potential suppliers involved in negotiations. This was the first project of this kind that enjoyed the benefits of

competition, and the results of it were very favorable for us. Other projects of that period were tied from the beginning to specific suppliers, and they had much more difficulty in getting what they wanted in their negotiations.

2. Lieutenant Commander CCC

Lt CDR. CCC is the current Project Manager. As Admiral AAA and his predecessor at project Kilo, he is an Electronic Engineer. He has also advanced studies in missiles.

Before becoming Project Manager he was Inspector at ALPHA facilities, and now he has completed two years at the head of the project.

From the beginning of this research, Lt CDR CCC has been quite helpful and interested in it. While most Project Managers could feel reluctant to have their territory scrutinized by an outsider, he has shown particular interest in the learning and experience building that can be achieved in a critical review of the project.

Since the contact has been very frequent and in several different occasions between January and November, 1995, this section will reproduce a synthesis of the main issues discussed with him.

- How was the decision to procure a missile system like Kilo taken?

The operational need was defined in a study made by the Navy General Staff. Several methods were considered to meet that need, and finally a missile system was selected, since it provided a better response. One year after that decision the contract was signed.

- What was the critical factor for selecting ALPHA among the potential offerors?

The main factor was price. ALPHA system had almost half of the price of the closest competitor.

- How were the specifications for the system defined?

The system was required to satisfy the tactical requirements both individually and as a set of systems on board two and three ships, according to the characteristics and number of simultaneous targets.

- The contract was signed with ALPHA, but three other companies were involved. What kind of relationships did the Project Team had with them?

ALPHA and its subsidiaries conformed a close network of prime and subcontractors. Technical matters were discussed directly with the subcontractor involved, but financial or contractual issues were treated exclusively with ALPHA.

- What is your opinion of the contract?

In general is a good contract, specially for the termination clause, which provides a reasonable leverage. It has though certain weaknesses, which are:

a) Hard to manage because of the ambiguity of some of its terms.

b) The reception of fragmented subsystems after factory tests does not ensure the functioning of the system once installed and integrated.

c) The up front payment of 60% of the price and 30% on Factory Acceptance left only a 10% for installation and integration.

- What do you think were the reasons for these weaknesses?

I think it was mainly good faith and trust in ALPHA. The Project Manager was also under pressure for the demands of the Navy and the potential contractors, and for the lack of financing.

Another problem was the lack of experts in business and weapon procurement with long permanence in the Navy. The legal department composed by only one lawyer was insufficient to provide due attention to the negotiation process.

3. Commander NNN

Commander NNN had been just promoted to Lieutenant Commander when he was appointed as the Project Manager for Project "Lima". That project was related to C3I capabilities in the fleet, and like Project Kilo, was the materialization of one of the recommendations of the Fleet Repowering Study. Although his Project was smaller than Project Kilo, he had the chance to follow the events that led to the creation of Program Horizon, and became the coordinator for the Program.[37] Although Lt CDR NNN had not the academic background of his Kilo counterpart, he had great experience at fleet tactical issues. The interview referred here was conducted in June 1995.

---

[37] The organization chart of Program Horizon is shown in Chapter IV.

- Commander, what was the origin of Program Horizon?

Program Horizon started two years before it was formalized as such. After the FALKLANDS War, The Navy General Staff conducted the Fleet Repowering Study. That study gathered the experiences of the war, which showed several weaknesses that had to be overcome if a similar conflict was to be faced with certain chance of success. The recommendations of the study triggered four different projects, among them Kilo and Mike. Each project had its own dynamics and was subordinated to different Program Managers. Most of the contracts, including the one with ALPHA, were negotiated under those circumstances. The contracts had their own time baseline and milestones, and it was soon realized that coordination was going to be a major problem during the installation and integration phases. Project Managers were all part-time, and it was very hard to stay in touch with the other Project Managers, attend the requirements from our regular jobs, and keep up with our own projects.

One of the Program Managers promoted the centralization of the projects under one program, which the Commander in Chief considered appropriate. Program Horizon became a reality. It was a lean organization, with all four Project Managers working with great autonomy. The program provided administrative support, centralized accounting control and coordination of activities. Movements of funds between projects were used to get more flexibility in dealing with changes in the projects.

- Some of the projects suffered important changes or delays. Was the program prepared for those events?

All the projects, and Kilo was not the exception, had very stringent requirements in terms of performance and schedule. Horizon Program Manager, Admiral JJJ, knew that it was not probable that all the contractors fulfilled their contracts completely. The strategy was to be alert for the events, and try to take advantage of the weakness of the contractors obtaining concessions from them.

- What was your position at Program Horizon, and how did it work out?

I was named coordinator of the Program. My task was to keep track of the planned activities of all the projects, and make sure that the same ship was going to be at the same

place at the same time, and that what one project does do not interfere with the other. I also tried to optimize the use of time coordinating simultaneous activities with two or more projects. I had no formal authority over the Project Managers, my job was a staff work for the Program Manager and in support of the Project Managers.

- How were the interactions within Program Horizon organization?

There were only two levels of authority in the organization: The Program Manager and the Project managers, who reported directly to him. Admiral AAA had a truly open door policy with the Project Managers. They could drop off by his office at any time, but Admiral AAA demanded from them initiative and leadership. He expected to be informed about solutions already being implemented rather than being asked to authorize determined courses of action. He acted mostly as a strategist, ensuring the budgetary health of the program, handling relationships between different projects, and guiding negotiations where the really big and complicated issues were being discussed.

C. INTERVIEWS WITH EXPERTS

1. Professor Mark W. Stone

Professor Stone teaches Acquisition and Contracting courses at the Naval Postgraduate School since 1993. Graduated as Attorney from the Santa Clara University School of Law, he worked at Apple Computer Corp and for ARGOSystems (a division of Boeing) before joining the Naval Postgraduate School.

The purpose of this interview was to get insight about the characteristics and differences between private and military contracting practices, both of which Professor Stone knows in deep.

The following is an extract from the interview conducted at NPS on August 30, 1995:

- I will make the assumption that the contract is the reflect of the negotiation process. Is that a fair assumption?

In general yes, at least is the formalization of the negotiation process and should reflect it results.

- In the context of contracting for unique equipment or technology, not readily available in the marketplace, what are the difference between private and military

negotiation and contracting practices?

First of all, private contracting is based and evaluated on the basis of profit making. When negotiating a contract, the private program manager looks at the new equipment or technology as a cost component which has to produce profits through the sales of the end product. This new component must provide the feature needed within the time constraint given by the market window.

The quantities involved in military sales will hardly exceed a couple of thousands units, which for private business is insignificant. Commercial items sales compensate for the investment as sold in large quantities. The contractor who provides the technology or equipment can be compensated on the basis of royalties, or paid directly for their work.

Another difference is that private firms conduct more "in house" development projects. However, there is an increasing use of joint ventures to combine the technologies of several and even competing firms to set standards and to optimize the design of the components with the point of view of the user. Most frequently these alliances will look at marketing, strategic and co-development goals, grouping several independent competitors in an industry in a handful of dominant conglomerates. An example was the Motorola-IBM-Apple alliance to produce the Power PC.

- Are "cost plus" contracts common in the private sector?

No, they are not used. Private companies invest in multiple projects expecting that the successful ventures will pay for the unsuccessful ones. In that situation, the narrow margins considered in cost plus contracts (around 7%) are not acceptable. Firms engaging in leading edge markets invest heavily in development, and plan for markups in the range of 25%. A big part of that markup will be used to reinvest in the development of new products in order to stay in business.

- How can the company who contracts for a unique development handle the risk involved in terms of delivery schedule and performance?

Contracts usually include arrangements for the purposes of oversight and report on the advance of the project, and also consider exit points in case something goes so wrong that can not be solved.

In any case, the key for risk handling is a good working relationship between the parts. Frequent meetings, open communications, teaming and trust building allow early acknowledgment of potential problems and collaboration in the evaluation and solution of them.

- To what extent the contract can help to create those relationship?

The contract can provide the oversight and communications mechanisms necessary to keep the relationship going, but the relationship must be created from the very beginning of the negotiation, and usually goes beyond the current contract. The contractor wishes to perform to stay in business and ensure more contracts, and the customer wants to keep that supplier which can perform such a special or unique work.

It helps to have a solid contract, where the expectations and obligations are clearly stated and understood by both parties, and they represent fairly the outcome of the negotiation. Such a contract should ideally be written, signed and never looked again. The shared and unequivocal understanding is what really counts.

Some companies have put increasing emphasis in relationship building teaming. There is a tendency in corporations towards teamwork. In the case of the Motorola-IBM-Apple joint venture several symbols were interchanged, like mugs and tee-shirts, to emphasize the team work.

- And what if something goes wrong, what are the options that contracts provide for?

Most of the times when the contractor has problems to fulfill in the expected schedule or with the expected performance, they negotiate with customer to find a solution for that problem, or to terminate the project if it is not viable anymore. The contract may have incentives or remedies for an eventual failure of the contractor.

The customer has to make the decision to go for a negotiated solution or to simply breach the contract. In any case, very few cases end up in litigation. The use of remedies or late fees to "punish" the contractor may help to recover some money, but will ruin the relationships with the contractor. Instead, arrangements may be made to get a fair settlement between the parts.

- How are these issues handled in international contracts?

The relationship building gets much more of attention. Issues to be handled include different culture, customs and different meaning of what is appropriate, legal or ethical. In the case of Japanese businessmen, you can expect to have up to three days of social meetings talking of everything but business. They want to get acquainted and create a relationship with their counterparts before the beginning of real business. Counterparts will be willing to know beforehand what behaviors and practices are considered appropriate. Companies like Apple have training seminars to prepare businessmen/women for overseas assignments.

- Is it usual to look for a third country to sign the contract in?

It is common practice. Each party might feel at disadvantage if the contract is signed under the jurisdiction of the other party. They naturally expect that under a legal litigation a judge will tend to favor the local party. Being that a fair assessment or not, it is better to look for neutral grounds. London is a usual selections, since they have experience in that issue. Even between two sates in the U.S. they might sign under the laws of New York, which is very developed and predictable for business issues. Predictability allows the parties to make better decisions about what issues are worth to spend money and time in litigation for them. Arbitration is more often used than actual legal litigation.

- Going back to risk handling. How does private firms arrange for eventual delays? Do they pay once the work is ended or depending on progress? Do they pay important amounts up front?

Private development projects will not be sitting out for too long. Usually payment is made on delivery, but a certain amount is paid up front. That amount is required to provide the contractor with the initial funds to start the project, and the amount will depend on the size and the financial capacity of the company relative to the project cost. It may range from 25% to over 50%. This up front payment is not made in cash, but in a letter of credit in a bank. The contractor can not draw any cash from that letter of credit, but can use it as financial backup. The letter of credit is handed over on delivery, or can be partially drawn on an advance basis. All of this is negotiated.

- How are decisions like source selection made in private businesses?

If there is a critical project with no choice of sources, the decision to go or not will be taken at the highest level based in the reports of the project manager. That report must assess the feasibility, cost, profitability and risk of the project.

We are talking about special projects, where there is not really open competition. Having two or three potential contractors is not really competition. Once the project is approved, the project manager or his/her business staff will select the participants with little intervention from above. The program manager has the authority and responsibility for the success and profitability of the project.

- How are the contracts designed and written?

The project manager explain to the legal or contracting staff what does he/she wants in the contract, and the specialists write it accordingly. They may also advice the project manager about legal contracting issues, but the advice is more appropriate at the negotiation stage. The responsibility for contract design lies on the project manager.

- Why is that so different in government contracting?

While corporations report only to their stockholders in terms of profit, government agencies represent the interest of all taxpayers, and success can not be measured objectively. The media looks for any issue that seems dishonest or inefficient, GAO will promptly look at it, while congressmen are ready to fight fraud, waste and abuse.

The resultant is a system based on mutual mistrust, between the agencies within the government and between contracting agency and contractor. In this system, is not considered appropriate that the program manager works a deal and design the contract. Rather than that, a contracting officer reporting to other chain of command will sign the contract, hopefully in accordance with the deal negotiated by the program manager. In some cases, contracting officers conduct independent negotiations according with his/her agenda, overriding the program manager.

Other limitation is that the government agency has to accept bids or proposal from any competitor. If there are reservations about the honesty or performance of the offeror, they must be proven by the contracting agency. Private business, in contrast, can do business with

whoever they want to. If the contractor has a bad reputation or bad previous experiences, its offer may not be considered and no protest can be issued. This is another tacit incentive for contractors to act honestly in private business.

There is no "standard of conduct" establishing a minimum legal behavior in private business. Ethics are internal values held by the actors. If their standards go below the legal threshold, they might restraint to act in order to stay in business. Ethic behavior is relevant as perceived by the customer, and is essential to nurture the relationship between the parties.

2. Interview with ARGOSystems Executives

ARGOSystem is a subsidiary of BOEING CO. dedicated to manufacture Electronic Warfare and communications devices for military applications. Their customer base include US defense contractors to which ARGOSystems provide components, and foreign military services, which buy complete systems as well as components. ARGOSystems is a relatively small company, with annual revenues close to 100 million dollars. Its technological sophistication and international business record made this company a good place to look for private business practices at a scale comparable to Project Kilo. The focus of the interview was to learn the usual procurement and contracting practices followed by private firms and foreign military services.

This interview was conducted at ARGOSystems headquarters al Sunnyvale, CA. The executives attending to it were:

- Joseph Gruender, Director of Contracts.
- Michael Gotskind, International Contracts Manager.
- Gary Flood, Director of Electronic Warfare and Surveillance Systems.
- Robert Blanchfield, Director of Materiel Operations.

- To what extent private firms acquiring unique pieces of equipment face the same kind of challenges that the military have in weapon procurement?

Private procurement can be even harder, because of the lack of regulations. Federal Acquisition Regulations, and the audits performed under those regulations actually help companies, making military contracts safe, although more expensive.

- How do private firms handle the risks and uncertainties in those procurements?

Basically they deal in dollars, meaning that they cover risks with higher husbands. Another method is having insurance covering for failure to comply. People with experience in the area is an important risk reduction mean.

In protecting against poor contractor performance we look at the records of the company. However records must be studied carefully and discussed to isolate the reasons for a problem, and to what extent it might present itself in the current contract.

Aggressiveness in legal issues is also another issue to explore. It is a matter of policy for a company to rely in good relationships to solve conflicts or to fight for every issue in court if necessary. Companies in the U.S. are required to disclose their relevant law suits, which is a good source of information before contracting.

- What types of contracts are used between private firms (Fixed price, Cost+%, Time and Materials, or else)?

Only fixed price contracts are used, sometimes with escalation formulas to adjust for variables which are not controllable by the contractor. Cost plus contracts are not feasible without Cost Accounting Standards.

- What devices are included in the contracts to protect the parties from the expected and unexpected risks, like warranties, escrow accounts, letters of credit, exit points, milestones, advance monitoring, progress payment, late fees, incentives, remedies or else?

The risk of non compliance is handled withholding a percentage of the total price, usually a 10%, until tests are completed. If possible, tests are completed at the factory, which is preferred by the manufacturers because no withhold is necessary after delivery. If external signals or other systems are required, tests are performed on site. If still compliance is not achieved, buyers can recourse to legal solutions or negotiated agreements. Usually bank guarantees are used to back compliance promises or breach of contract.

Letters of credit are usual as a backup for up front payments, which can exceed 60% of the price, according to the capital requirements to perform the contract and the size of the contractor.

Warranties have a different use, and are more limited in use than compliance clauses. Warranties refer usually to materials and workmanship, and cover for 12 to 18 months after delivery, or a certain period after installation, but rarely beyond 24 months. There can be design and functional warranties, but they tend to be quite expensive. The company has to back the warranty with contingency funds, materials and spare parts, and report it as a liability, which involve cost of money. Another limitation is that subcontractor work is not passed through the prime contractor to the buyer. An important part of the parts are components are bought well before they are actually used, either to ensure critical parts of the job or to buy in convenient quantities. Usually these limitations are written in the exclusions.

Although it is not usual, some large companies prefer self insurance and negotiate lower prices.

- What problem-solving devices are used to handle conflicts?

The preferred way to solve and even prevent problems is to establish good communications between the companies. "Get the lawyers to talk" is a good practice during negotiations and after.

When conflicts arise at the Project Manager level, it is usual that the issue is taken to a higher level. It is expected that senior executives have a less involved point of view, and they care more for the long term success and reputation of the firm than the short term issues of the project.

- What is the typical size and organization of a Project manager office in private firms?

When small firms like ours make big procurements they appoint an executive as Project Manager on a part-time basis. In ARGOSystems the Project Manager can be up to a vice-president, depending on the amount involved and the importance of the project.

We cannot afford to have a full-time Project Manager. Besides, the Project manager is usually in charge of the area where the equipment will be used, so he has vested interest and ample knowledge about it. We do provide support to Project Managers from headquarters people or external consultant if necessary. Finally the Project Manager has to

decide in terms of cost-benefit and respond for the good use of resources.

- In your experience, how does foreign military services approach contractors and negotiate contracts?

They usually approach contractors with "Request for Information" for a specific requirement. Firms respond in four to six months with technical information, preliminary price figures, and background information about technical and financial capabilities, as well as past achievements. The buyer use the information from all the respondents to create the specifications, taking the best of each one.

The following step is a tour to the preselected contractors, to have a closer idea of the real capabilities of the contractor. Sometimes buyers interchange information about contractors and their systems (This is particularly usual in Europe). Apart from performance, buyers are concerned with other issues. Interoperability is a big thrust.

Among our foreign customers, Australia has the most elaborate process to control time and performance. They break the work in measurable and discrete packages, including the end items and documentation.

APPENDIX D: RESEARCH QUESTIONS

A. OVERVIEW

This appendix addresses the main and subsidiary research questions, according to the results of the analysis.

B. RESEARCH QUESTIONS

1. Main Research Question

- ***Did the contracting practices of the Chilean Navy deal appropriately with the uncertainties and complexities involved in this acquisition?***

According to the analysis, it can be stated that Navy contracting practices as applied to Project Kilo were not completely appropriate, due to the lack of legal and business expertise in the Project Team, and the lack of a thorough risk assessment.

In the positive side, the contract provided an efficient mechanism to trade schedule slippage for cost, and avoided most of the factors that produce cost increases in fixed price contracts. Keeping good relationships with the supplier and flexibility to address the problems was also a fruitful practice.

The success of the project reflects that good practices and competence prevailed over the deficiencies in expertise and risk assessment.

2. Subsidiary Research Questions

The answers to the subsidiary research questions, according to the analysis, are the following:

- *What are the challenges that the Chilean Navy faces when trying to acquire major weapon systems?*

- *What are the general political, legal, financial and technical constraints involved in major systems procurement?*

The answer to these two questions is summarized in the fifteen general challenges and constraints identified and explained in Chapter IV:

1. Acquiring Effective Weapons Without a Technology Base
2. Determining the Appropriate Maturity of Technology
3. Determining Degree of National Participation
4. High Impact of Failure
5. Project Manager Rotation
6. Lack of Experience and Information
7. Maintaining Political Support
8. Multiplicity of Actors and Goals
9. Need for Communication and Negotiation Skills
10. Scarce Resources; Few Major Projects
11. Need for External Financing
12. Lack of Cost and Pricing Data
13. Structure of Technology
14. Difficulty of Technology Transfer
15. Immaturity of Contract Management Regulations

- *Was the Chilean Navy properly organized and manned for Contracting?*

As mentioned before, the Navy was not properly organized and manned when the contract was negotiated. It improved significantly though when Program Horizon was created.

- *What were the specific contracting challenges and constraints for the case under analysis?*

Project Kilo challenges were different from the general ones as explained in the first conclusion. It had consistent political support, consensus among the relevant actors and long permanence of project managers. The additional challenge was the cultural difference with Omega.

- *How did the Contracting Team deal with those general and specific challenges and constraints?*

Although without the required expertise, the Project Team was successful in putting together a contract that achieved the purpose of the project. The team kept good relationships with ALPHA and was flexible to renegotiate the contract as required by the circumstances. Project risks were not thoroughly assessed, but fortunately the worst events that could have happened did not materialize.

- *What conditions influenced the positive and negative outcomes of the contract?*

The positive outcomes resulted mainly from the competence of Project Kilo team members, commitment of resources over a long period and stable political support within the Navy. The only negative result, getting the system two years after the expected date, was the result of the initial degree of development of the weapon system, and the lack of strong incentives and mechanisms to enforce compliance.

- *What could have been done to make the procurement process better within the current constraints?*

As mentioned in conclusion number 13, the following actions could have improved the negotiation process and contract conditions:

- Including contractual terms and conditions in the source selection.
- Having a more complete and expert negotiation team.
- Including all relevant actors in decision making.
- Assessing risks, worst case scenarios and contingency plans for failure.
- Ensuring participation of Omega Navy before committing to a contract.
- Reducing financial dependence to the up front payment.
- Relating the cash flow to actual deliveries of working and integrated subsystems.
- Including performance test protocols in the contract.
- Allowing for minor changes agreed by the parties.

- Exploring the possibility of future projects with ALPHA.
- *What can be done in the future to improve management conditions and eliminate constraints for achievement of better contracts?*

The following are recommendations that, if implemented, should improve the results of future procurement processes. They are explained in detail in Chapter VI:

(a) Keep long term commitment to education, and extend it to negotiation and communication skills

(b) Maintain the capability to put together teams with multiple skills.

(c) Ensure long term budgetary commitment to make big projects possible

(d) Involve all relevant actors in decision making

(e) Recognize the power of non contracting means in negotiations.

(f) Be wise and cautious in the use of competition.

(g) Reduce financial dependence on the contractor.

(h) Write measurable requirements that ensure performance and supportability.

(i) Consider high involvement and r&m requirements to reduce after sales support risk.

(j) Provide flexibility and resources to take advantage of opportunities.

(k) Define and prepare for eventual failures to reduce risk.

(l) Negotiate to obtain win-win conditions in order to have better chances for long term success.

(m) Conduct further research in the areas of weapon procurement risk, negotiation and project management.

(n) Provide better training and guidance to Project Managers.

BIBLIOGRAPHY

1. "Acquisition Strategy Guide", Defense Systems Management College, Fort Belvoir, Virginia, 1984.

2. DoD Directive 5000.1, Feb 23,1991, "Defense Acquisition"

3. "Estudio de Repotenciamiento de la Escuadra", Estado mayor General de la Armada, 1985.

4. Karrass, Gary, "Negotiate to Close, How to Make More Successful Deals". Simon & Schuster, 1985. ISBN 0-671-55483-2.

5. Mack, Ruth P., "Planning on Uncertainty, Decision Making in Government and Business Administration." John Wiley and Sons Inc. 1971, ISBN 0-47-56280.

6. "Manual de Proyectos de la Armada", Reglamento 5-41/1-03, 1985.

7. Martínez Busch, Jorge, "Política Oceánica Nacional, Sugerencias Para Una Formulación." Servicio Hidrográfico y Oceanográfico de la Armada, 1994, Valparaíso, Chile.

8. Paret, Peter, with Graig, Gordon and Gilbert, Felix. "Makers of Modern Strategy, from Machiaveli to the Nuclear Age." Princeton University Press, 1986, ISBN 0-691-02764-1.

9. Sushka, Peter William Jr., "A Comparative Study of the Navy Project Manager and His Civilian Counterpart in Industry." March 1976, Naval Postgraduate School, Monterey California, Thesis number T 171685.

10. Yuspeh, Larry. "A Case for Increasing the Use of Competitive Procurement in the Department of Defense." Included in:"Bidding and Auctioning for Procurement and Allocation, Proceedings of a Conference at the Center for Applied Economics." Edited by Yakov Amihud, New York University Press, 1976, ISBN 0-8147-0558-8.

INITIAL DISTRIBUTION LIST

1. Defense Technical Information Center 2
   8725 John J. Kingman Road, Suite 0944
   Ft. Belvoir, VA 22060-6218

2. Library, Code 013 2
   Naval Postgraduate School
   Monterey CA 93943-5101

3. Eduardo Troncoso 2
   Estado Mayor General De La Armada
   Correo Naval
   Valparaiso, Chile

4. Thomas H. Hoivik, SM/Ho 2
   Naval Postgraduate School
   Monterey CA 93943-5101

5. Katsuaki L. Terasawa, SM/Tk 1
   Naval Postgraduate School
   Monterey CA 93943-5101

6. Roger Evered, SM/Ex 1
   Naval Postgraduate School
   Monterey CA 93943-5101

7. Donald R. Eaton, SM/El 1
   Naval Postgraduate School
   Monterey CA 93943-5101

8. Mark W. Stone, SM/St 1
   Naval Postgraduate School
   Monterey CA 93943-5101

9. David V. Lamm, SM/Lt 1
   Naval Postgraduate School
   Monterey CA 93943-5101